PRODUCTION CONSTRAINTS AND CHOICE OF FARMING PRACTICES ACROSS SELECTED SMALLHOLDER FARMING SYSTEMS IN KWAZULU-NATAL

BY

MFUNDO MDLOZINI

SUBMITTED IN FULFILMENT OF THE REQUIREMENTS FOR THE DEGREE OF MASTER OF SCIENCE

IN

AGRICULTURE

IN THE

SCHOOL OF AGRICULTURAL, EARTH AND ENVIRONMENTAL SCIENCES

UNIVERSITY OF KWAZULU-NATAL

PIETERMARITZBURG

MARCH 2017

As the candidate's supervisors, we have approved this dissertation for submission.

Signed: _____ Date: _____

Dr. Maxwell Mudhara (Supervisor)

Signed: _____ Date: _____

Prof. Paramu Mafongoya (Co-supervisor)

DECLARATION 1- PLAGIARISM

I, Mfundo Mdlozini, declare that:

1. The research reported in this thesis is my own original work, except where otherwise indicated.
2. This dissertation has not been submitted for any degree or examination at any other university.
3. This dissertation does not contain other people's data, pictures, graphs, etc., unless specifically acknowledged as being sourced from those people.
4. This thesis/dissertation does not contain other authors' writing, unless acknowledged, in detail, as being sourced from other authors. Where other written sources have been quoted, then:
   a) Their words have been re-written but the general information attributed to them has been referenced.
   b) Their writing has been placed in quotation marks and referenced where their exact words have been used.
5. This dissertation does not contain text, graphics or tables copied and pasted from the internet, unless the particular source is specifically recognised in the dissertation and the reference section.

Signed: _____ Date: _____

Mfundo Mdlozini (Student)

DECLARATION 2 - PUBLICATIONS

The following form part of the study presented in this dissertation.

Manuscript 1:

Mfundo Mdlozini, Maxwell Mudhara & Paramu Mafongoya (2016). Analysis of constraints faced by smallholders and their influence on farm production in KwaZulu-Natal province of South Africa.

Manuscript 2:

Mfundo Mdlozini, Maxwell Mudhara & Paramu Mafongoya (2016). Analysis of factors influencing smallholder farmers' choice of farming practices in KwaZulu-Natal province of South Africa.

ACKNOWLEDGEMENTS

First and foremost, I would like to express special thanks for the privilege of working with insightful and knowledgeable supervisors, Dr Maxwell Mudhara and Professor Paramu Mafongoya. It was their encouragement, patience and critical support that enabled me to achieve my objective of completing this study. The preparation and writing up of this research proved to be extremely difficult and time-consuming. You really helped me organise my thoughts with your extensive input and alternative insights for the improvement of this thesis. Without your constant supervision, the completion of this study would not have been possible.

My sincere gratitude also goes to the National Research Foundation (NRF), for providing me with generous financial assistance that made this study possible. I am truly grateful for the financial support throughout the research period. Thank you very much and continue with the great job.

I would also like to extend my gratitude to the Extension Officers from the provincial Department of Agriculture and Rural Development in Ndwedwe and Umzimkhulu Local Municipalities, for taking the time to introduce me to the sampled farming households in both study areas. To all the survey households who completed the questionnaires, thank you. Your immense contribution have made it possible for me to gather all the required data to compile this study. I would like to thank my enumerators from the School of Agricultural, Earth and Environmental Sciences (SAEES), University of KwaZulu-Natal, for a wonderful job during data collection. Special attributes are owed to my dear mother, uncle and all my brothers and sisters, for their constant encouragement and support. Finally, but obviously not the least, I would like to thank God for this wonderful opportunity and all the experiences it brought into my life. Most of all, I am thankful to be given another chance to get up again. You made it all possible for me.

ABSTRACT

The agricultural sector continues to stimulate economic growth for developing economies. This phenomenon relates to South Africa, where agriculture plays a crucial role in livelihood creation and economic growth in the country's rural areas. Smallholder farmers are drivers of many economies in Africa, even though their potential is often overlooked. South Africa's rural development framework in the National Development Plan (NDP) shows that smallholder agriculture has a prospective role in developing the country's rural economy. However, rural households continue to derive a small proportion of their livelihoods directly from agriculture because of a number of constraints. This study, on smallholders in KwaZulu-Natal province of South Africa, investigated the constraints they face and their effects on farm production, as well as the factors influencing their choice of farming practices. The main question is whether or not smallholder agriculture can significantly contribute to economic development in poor rural households.

Data were drawn from a sample of 400 farmers in Ndwedwe and Umzimkhulu Local Municipalities in KwaZulu-Natal province, using a structured questionnaire. Farmers were selected using multistage randomised sampling technique. Descriptive statistics were used to explain farm level characteristics. The Principal Component Analysis (PCA) was used to transform a set of inter-related variables into core uncorrelated factors. The Tobit regression model was used in assessing the determinants of production constraints faced by smallholder farmers and their effect on agricultural production, while the multinomial logistic (MNL) regression model was used to examine and identify the factors influencing farmers' choice of farming practices.

The study findings revealed that smallholder farmers faced limited access to agricultural land and farm services in and/or out for the farm, e.g. produce markets, infrastructure, credit facilities and extension. The estimated results of the Tobit model showed that farm level characteristics statistically and significantly influenced the production constraints in KwaZulu-Natal and the measures needed to improve smallholder agricultural production include easing access to agricultural land, credit facilities, extension and markets, in order to encourage farm innovation through the adoption of improved farming practices. The common farming practices of choice were subsistence crop farming, improved crop farming and mixed farming. The estimated results of the MNL model showed that the common choice of farming practices was statistically and significantly influenced by various factors, which included

total land size, type of land, market access, household size, education level and age of the household head.

The study concluded that smallholders seek to increase agricultural production in order to improve their livelihoods. It recommends that, given the constraints they are facing, strategic measures to increase access to agricultural land and farm services in and/or out of the farm should be implemented jointly, so that farmers would be more inclined to improve their farming practices. These farmers should form co-operatives for easy access to improved farming inputs from financial institutions, local government and NGOs. Development agents should facilitate, safeguard and promote awareness of productive farming practices in order to improve their adoption in rural areas. Farm opportunities should be explored to encourage smallholders to diversify farming practices. Research should identify adapted, efficient and high-yielding farming practices to improve agricultural production and livelihoods of smallholders. Policies and investment priorities should recognise available opportunities and constraints facing farmers and empower them to create an enabling environment to improve farm production.

Key words: Smallholders, livelihoods, economic growth, rural households, production constraints, farming practices, Principal Component Analysis, Tobit, multinomial logistic regression.

TABLE OF CONTENTS

DECLARATION 1- PLAGIARISM ..... **ii**
DECLARATION 2- PUBLICATION ..... **iii**
ACKNOWLEDGEMENTS ..... **iv**
ABSTRACT ..... **v**
TABLE OF CONTENT ..... **vi**
LIST OF TABLES ..... **xi**
LIST OF FIGURES ..... **xii**
LIST OF ABBREVIATIONS ..... **xiii**

CHAPTER 1
INTRODUCTION

1.1 Background and justification 1
1.2 Problem statement 3
1.3 Study objectives 6
1.3.1 Specific objectives 6
1.4 Hypotheses 6
1.5 Outline of the thesis 7

CHAPTER 2
LITERATURE REVIEW OF SOUTH AFRICA'S SMALLHOLDER AGRICULTURE

2.1 Introduction 8
2.2 Definition of a smallholder 8
2.3 Characteristics of smallholder agriculture 9
2.4 Role of smallholder agriculture in economic development 10
2.4.1 Employment creation 10
2.4.2 Poverty alleviation 10
2.4.3 Improved household income 11
2.4.4 Linkages for economic growth 11
2.5 Farming practices 11
2.5.1 Subsistence farming 12
2.5.2 Diversified farming 13

2.5.3 Commercial farming 14
2.6 Smallholder farmers' resource levels 14
2.7 Constraints to smallholder agricultural development 16
2.7.1 Limited access to agricultural land 17
2.7.2 Traditional farming technologies 17
2.7.3 Limited access to affordable credit 18
2.7.4 Ineffective farm extension services 18
2.7.5 Limited access to formal markets 19
2.8 Techniques for constraint identification and analyses 19
2.8.1 Measuring constraints facing smallholder farmers 20
2.8.2 Measuring farmers' choice of farming practices 21
2.9 Summary 21

CHAPTER 3

CONSTRAINTS TO SMALLHOLDER FARMERS' AGRICULTURAL PRODUCTION IN KWAZULU-NATAL PROVINCE, SOUTH AFRICA

3.1 Introduction 24
3.2 Households' farm level characteristics 25
3.3 Methodology 26
3.3.1 Study area 26
3.3.2 Data collection 28
3.3.3 Sampling procedure 28
3.3.4 Data analysis 29
3.3.5 Model specification 29
3.3.6 Explanatory variables used in the Tobit model and their *a priori* expectations 31
3.4 Empirical results of the study 36
3.4.1 Descriptive statistics of farm level socio-economic characteristics 36
3.4.2 Factors influencing smallholder farmers' production constraints 38
3.4.2.1 Results of the Principal Component Analysis 38
3.4.2.2 Results of the Tobit regression analysis of the factors influencing smallholders' production constraints 39
3.5 Discussions 39
3.5.1 Households' farm level and socio-economic characteristics 41

3.5.2 Factors influencing smallholder farmers' production constraints 43
3.6 Conclusion and recommendations 46

CHAPTER 4

FACTORS INFLUENCING FARMERS' CHOICE OF FARMING PRACTICES IN KWAZULU-NATAL

4.1 Introduction 49
4.2 Methodology 50
4.2.1 Study area 50
4.2.2 Data collection 50
4.2.3 Sampling procedure 50
4.2.4 Data analyses 51
4.2.5 Model specification 51
4.2.6 Explanatory variables used in the MNL model and their *a priori* expectations 52
4.3 Empirical results of the study 58
4.3.1 Descriptive statistics of farm level socio-economic characteristics 58
4.3.1.1 Smallholder farmers' goals and aspirations 59
4.3.2 Factors influencing farmers' choice of farming practices 59
4.3.2.1 Statistical and specification tests 59
4.3.2.2 Results of the MNL analysis of factors influencing farmers' choice of farming practices 60
4.4 Discussions 62
4.4.1 Households' farm level socio-economic characteristics 62
4.4.1.1 Smallholder farmers' goals and aspirations 64
4.4.2 Factors influencing farmers choice of farming practices 64
4.5 Conclusion and recommendations 66

CHAPTER 5

SUMMARY, CONCLUSION AND STUDY RECOMMENDATIONS

5.1 Summary of the study 68
5.2 Conclusion 69
5.3 Study recommendations 69
References 71

APPENDIX 88
APPENDIX A: Research questionnaire 88

LIST OF TABLES

Table 1: Description of key variables included in the Tobit model 32
Table 2: Descriptive statistics of selected farm level characteristics (N=400) 37
Table 3: Number of extracted PCs, eigenvalues and variance explained 38
Table 4: Variables loaded in the PCs and component loadings 38
Table 5: Tobit regression estimates of determinants of constraints faced by smallholder farmers (N=400) 40
Table 6: Description of key variables included in the MNL model 53
Table 7: Descriptive statistics of selected farm level socio-economic characteristics 58
Table 8: Smallholder farmers' goals and aspirations 59
Table 9: Statistical and specification tests 60
Table 10: MNL estimates of determinants of farming practices (N=400) 61

LIST OF FIGURES

Figure 3.1: Map of the study area within KZN province of South Africa 27

LIST OF ABBREVIATIONS

CASP	-	Comprehensive Agricultural Support Programme
DAFF	-	Department of Agriculture, Forestry and Fisheries
DBSA	-	Development Bank of Southern Africa
DFI	-	Development Finance Institution
DM	-	District Municipality
FAO	-	Food and Agriculture Organisation
FSP	-	Farmer Support Programme
FSS	-	Food Security Strategy
GDP	-	Gross Domestic Product
HFPP	-	Household Food Production Programme
LM	-	Local Municipality
MAFISA	-	Micro Agricultural Financial Institutions of South Africa
MNL	-	Multinomial logistic
NDA	-	National Department of Agriculture
NDP	-	National Development Plan
NGO	-	Non-Governmental Organisation
OLS	-	Ordinary Least Squires
OSMP	-	Organic Soil Management Practices
PC	-	Principal Component
PCA	-	Principal Component Analysis
PSU	-	Principal Sampling Units
KZN	-	KwaZulu-Natal province
SA	-	South Africa
SPSS	-	Statistical Package for the Social Sciences
SRS	-	Simple Random Sample
VIF	-	Variance Inflating Factor

CHAPTER 1

INTRODUCTION

1.1 Background and justification

The agricultural sector is the basis for developing economies and an important tool through which rural economic development can be achieved in communal areas of developing countries (DAFF, 2012). According to Senyolo *et al*. (2009), sustained farm production has become an ideal goal of agricultural development in South Africa. This view is integrated in SA's rural development framework in the National Development Plan (NDP), which pointed out the prospect of agriculture as the main driver in developing the country's rural areas in order to improve the livelihoods of approximately 2.6 million smallholder farmers who are faced with a number of production constraints in smallholder agriculture (Sikwela, 2013 and Zarenda, 2013).

Smallholder farmers are distinguished by marginal and sub-marginal rural households in developing countries, which constitute about 78% of the country's farmers whose livelihoods are reliant on agriculture (World Bank, 2016). These farmers own and/or cultivate less than two hectares of land (DAFF, 2012). According to Ortmann & King (2006), smallholders are not a homogeneous group because they differ in terms of available resource distribution between food and cash crops, farming capabilities and other farm level characteristics such as land size, cultivated area, livestock and crop activities, off-farm activities and household expenditure patterns. According to Marenya & Barrett (2011), the household economic portfolio provides a link between farmers' resource levels and capability to respond to farm opportunities.

Even though the agricultural sector has demonstrated great potential as a main driver of developing economies, the likely role of smallholder agriculture in developing rural areas has not yet been realised (Thapa, 2009). For example, smallholder agriculture is considered a low agricultural production activity in South Africa (SA), because of its simple, outdated farming technologies and low return production systems (DAFF, 2012). However, KZN is the prime agricultural region in SA (Ngcobo & Dladla, 2002). According to Sikwela (2013), farming is the main economic and social force in the province as it continues to improve the livelihoods of millions of rural households. According to Punt *et al*. (2005), the majority of the country's smallholder farmers are situated in KZN province and it is estimated that about 37.5% of the

provincial population is involved in agricultural activities, which include crops and livestock production.

KZN contributed about 16.5% of the total Gross Domestic Product (GDP) in 2003, which indicates great potential for farming (Punt *et al*., 2005). However, the contribution of smallholder agriculture to GDP is currently projected to be well below this potential, due to the constraints facing smallholder agriculture in SA (Ngcobo & Dladla, 2002). According Baloyi (2010) and DAFF (2012), the major production constraints includes limited access to agricultural land and farm services such as produce markets, farm extension, poor farm infrastructure and credit. These constraints are significantly influenced by a number of farm level characteristics, which include household size, age, gender, marital status, education level of the household head and poor property rights for women smallholders (Matungul *et al*., 2012; Senyolo *et al*., 2009; Sibanda, 2012). Xaba & Masuku (2012) mentioned limited access to information regarding produce prices, markets and lack of bargaining power. These production constraints serve as barriers for adoption of improved farming practices, which have a negative effect on smallholder agricultural production (Baloyi, 2010 and Uchezuba *et al*., 2009). For example, limited access to credit and agricultural land have a significant influence on smallholder farmers' capability to respond to farming opportunities such as adopting improved crop farming practices and accessing farm services such as farm extension support and formal markets (Jayne *et al*., 1999). Thus, when households face production constraints, their capacity to respond to innovative agricultural opportunities is reduced (DAFF, 2012).

The majority of South Africa's rural households have unsustainably small plots of land for farming and smallholder female farmers are at a disadvantage because of their limited access to local farm resources, especially land (Sibanda, 2012). However, according to the World Bank (2003), the size of land depends on the quality of available local resources, even though smallholder farmers are generally known to operate two or fewer hectares of land. The analysis of national studies on Sub-Saharan African countries such as Uganda and Malawi have shown significant differences in land sizes among rural households, where smallholders with large land sizes generated higher crop revenues and per capita income than those with small land sizes, who earned lower crop revenues and depended on off-farm income sources (Jayne, 2010).

Small farms have long demonstrated a strong productivity advantage over large farms, when productivity is measured in output per hectare, despite the constraints in smallholder agriculture (Feder & Noronha, 1987). The Sub-Saharan Africa and Asian countries have tried to encourage only large farms, as part of governments' efforts to strengthen agricultural production, because they assumed that smallholder agriculture is inefficient, backward and resistant to change (World Bank, 2003). According to the World Bank (2003), these countries only started to realise the need to support smallholder agriculture after collective farms failed to deliver adequate incentives to produce. This is similar to SA, where a large number of rural households have not experienced an effective farm support system from development agents (Jacobs, 2009).

The large number of rural households in smallholder agriculture permits attention to understanding their farming contexts in order to inform and implement an effective strategic approach to support their livelihoods (DAFF, 2012). It is also important to improve investment in farm technical skills and scientific efforts in order to maintain pace between growth in agricultural production and demand for food (Ruttan, 2002). However, a sustainable smallholder agricultural sector can only be realised by determining the specific constraints to its development, with emphasis on institutional, technical and entrepreneurial factors and farm level characteristics (Jacobs, 2009). Understanding the production constraints facing smallholder farmers in South Africa remains a critical step towards addressing them, in order to realise the potential of smallholder agriculture as an enhancement of livelihood strategies for rural households (Oettle *et al*., 1998). Co-operative development and the ability to address all the constraints simultaneously is considered an effective strategic approach through which smallholder agricultural growth can be realised in rural areas (DAFF, 2012). In line with the foregoing, the main purpose of this study was to examine the major factors influencing the production constraints faced by smallholder farmers in KwaZulu-Natal province of SA and their effects on agricultural production. The study further examined the specific factors influencing smallholder farmers' choice of farming practices.

1.2 Problem statement

The South African government and NGOs have emphasised the role of smallholder agriculture to ensure food security (Koo, 2014). The aim is to expand smallholder agriculture as part of the government's broader job creation strategy (Ngemntu, 2010). The Integrated

Food Security Strategy (FSS) was therefore introduced in 2002 to improve households' food production, trade and distribution, including efforts to improve farmers' access to resources such as land, technology, credit and extension (Koo, 2014). The SA's government further introduced the Comprehensive Agricultural Support Programme (CASP) in 2005, which incorporates the Household Food Production Programme (HFPP), targeted at rural households that fail to access adequate food (Jordaan *et al*., 2014 and Koo, 2014). The National Department of Agriculture (NDA) with the Development Finance Institution of South Africa (DFI) later introduced the Micro Agricultural Finance Initiative of South Africa (MAFISA) in 2006, which was followed shortly by the "One Home, One Garden" initiative in 2009, which was launched in KwaZulu-Natal to supply seeds, fertilizer, farm training and financial advice to rural households in communal areas, to encourage and prepare all rural households to produce their own food for household consumption and further supply local markets (Koo, 2014).

Even though the local government and NGOs have invested significantly in projects to assist smallholder farmers manage productive farms and improve rural livelihoods, their performance remains relatively poor (Jordaan *et al*., 2014). According to Lahiff & Cousins (2005), only a few farmers have managed to make significant progress, while many have proven unsustainable without major support from local governments and NGOs. According to Sikwela (2013), smallholder farmers are still struggling to improve and strengthen agricultural production. Thus the production levels of smallholder agriculture has been low in relation to inputs, resource accessibility and use over the past years (Monde, 2007). This is because the proposed 'economic programmes' are difficult to implement or require discretion-based interventions, more skills, clear understanding of constraints or better strategies (Aliber & Hall, 2012). Perhaps the limited contribution of smallholder agriculture towards agricultural growth and rural economic development is mainly caused by failure to clearly identify the specific roles required from projects employed through state organisations (Jordaan *et al*., 2014).

In South Africa, the decline in agricultural production of smallholder agriculture is assumed to be the result of constraints such as limited access to improved crop varieties, fertilizer and other farming resources, which are alleged to be largely attributed to the legacy of the apartheid regime's discriminatory policies and being by-passed by a number of macro level reform processes and exclusion of farm support that rural households used to receive from pre-1994 governments (DAFF, 2012 and Koo, 2014). The removal of government subsidies

has reduced farmers' incentive to produce, because some of the institutes that used to promote agriculture have collapsed and smallholders cannot afford the inputs in the required quantities (Koo, 2014). Thus South Africa's smallholder farmers continue to derive low output value directly from agriculture because of low farm production, where an increase in farm production is dependent on increased cultivated area (Muchara, 2011). Enete & Igbokwe (2009) added that per capita food production has declined over the past years, as has the share of the agricultural contribution to GDP. A significant decline in the latter, from 40% in the 1960s to 21% at the end of the century, was experienced in sub-Saharan countries, which probably reflected growth in other sectors (ECA, 2004). According to Ngemntu (2010), the production constraints have led to poor performance and prospective growth of smallholder agriculture. This is considered a major determinant of the recurrent increase in poverty and hunger in most South African communal areas. The problem is a constraint that is restraining (Kirsten & van Zyl, 1998). Vink & Van Rooyen (2009) added that it has become a challenge to build capacity across smallholder agriculture in South Africa, especially in resource constrained areas.

The challenge of limited access to farm services, effective agricultural resources and limited adoption of improved farming practices whose benefits are not well demonstrated within smallholder agriculture, remain major constraints affecting smallholder production levels (Hogset, 2005 and Somda *et al*., 2005). According to Mashingaidze (2012), the majority of smallholder farmers lack the skills and resources to adopt improved farming practices, while others do not have the incentives to adopt such farming technologies to replace outdated production systems. The prevalence of outdated production technologies is one of the major drawbacks to subsistence crop farming (Nkamleu *et al*., 2003). However, developing economies continue to demand extensive inclusion of smallholder farm output in ensuring rural economic growth and sustaining the ever-increasing demand for food and employment creation in rural areas, despite the production constraints in smallholder agriculture (Dixon *et al*., 2001). This calls for detailed assessment of smallholder farmers' aspirations, technical farming capabilities, output price expectations, formal markets and establishment of accurate policies, designs and sustainable strategies in order to achieve sustained rural economic development.

Even though the important role of agricultural growth and rural economic development in poverty alleviation have been realised, there is still inadequate implementation of specific strategies for improving agricultural growth in developing countries (World Bank, 2003). The

major challenge for development practitioners is considering strategies to adopt in order to address the constraints and eradicate poverty and hunger among South Africa's rural households (Hanmer & Naschold, 2001). According to DAFF (2012), an increase in agricultural production is essentially attributed to technical change. Advances in mechanical and biological technologies are primary sources of growth in land and labour productivities (Somda *et al*., 2005). Lahiff & Cousins (2005) added that, smallholder agricultural development is possible under favourable conditions. It is therefore important to increase investments in technical and scientific efforts to bridge the gap between growth in farm production and demand for food (Ruttan, 2002). Ruttan (2002) added that a viable smallholder agriculture can be realised by determining and addressing the constraints to its development, with emphasis on institutional, technical and entrepreneurial factors. A clear understanding of the constraints facing smallholders is important for providing a sound basis for investment in smallholder agriculture in order to realise its potential as a vehicle for poverty alleviation and enhancement of the standard of living of SA's poor rural households (Oettle *et al*., 1998).

1.3 Study objectives

On the basis of the foregoing, this study set out to assess the constraints facing smallholder farmers and their effects on agricultural production in communal areas of KwaZulu-Natal province.

1.3.1 Specific objectives

The specific objectives of the study are to:

1. Identify the constraints faced by smallholders and their effects on farm production in KwaZulu-Natal.
2. Identify the factors influencing smallholder farmers' choice of farming practices in KwaZulu-Natal.

1.4 Hypotheses

1. There are no constraints to South Africa's smallholder farmers that affects agricultural production.
2. Factors influencing the constraints to smallholder agricultural production and the choice of farming practices are not area-specific.

1.5 Outline of the thesis

This dissertation was written using the 'research' format. Chapter 1 was an introduction to the study. The remainder of the thesis advances as follows: Chapter 2 provides a detailed literature review of the study. Chapter 3 is a research paper that seek to identify the production constraints faced by smallholder farmers in KwaZulu-Natal province of South Africa, while chapter 4 is a research paper that seek to investigate the factors influencing farmers' choice of farming practices in KwaZulu-Natal. Chapter 5 concludes the study by providing a summary of the study conclusions and recommendations based on the study's major findings.

CHAPTER 2

LITERATURE REVIEW OF SOUTH AFRICA'S SMALLHOLDER AGRICULTURE

2.1 Introduction

This chapter presents a definition of a smallholder farmer, characterisation and importance of smallholder agriculture within the South African context, a review of literature on farmer's resource levels and constraints faced by smallholder farmers, as well as the theoretical literature on farming practices. The chapter begins by defining a smallholder farmer, which is followed by background and characterisation of smallholder agriculture in South Africa and its role in livelihood creation for rural households. The chapter highlights farmers' choice of farming practices and evaluates resource levels of households. Finally, the constraints and their effects on smallholder farm production in South Africa are reviewed in detail, with emphasis on farming as a main livelihood strategy. The elements in this chapter are important for understanding the dynamics of farm level characteristics within the South African agricultural economy, as an attempt to determine, analyse and address the production constraints facing South Africa's smallholder farmers in communal areas and how the smallholder agricultural sector can possibly contribute to poverty alleviation through rural economic growth.

2.2 Definition of a smallholder

The definition of a smallholder farmer varies between authors, countries and agro-ecological zones (Dixon *et al*., 2001; Mudhara, 2010; Narayanan & Gulati, 2002). Mudhara (2010) pointed out that some authors have indicated their limited resource and farm production levels, while others tended to emphasise their lack of land tenure. This explains the common usage of the term "smallholder" with "small-scale", "subsistence", "low-income", "resource poor" and "low-input" (Nagayets, 2005). According to Oettle *et al*. (1998), smallholder agriculture is diverse, but involves black rural households who are producing on unsustainable small plots of land with limited resources. In South Africa, the term "smallholder" is used to refer to the total number of black rural households involved in farming activities on a small scale (Ngemntu, 2010). South Africa's smallholder agriculture is characterised by non-productive, non-commercial and subsistence farming practices (Kirsten & van Zyl, 1998).

Smallholder farmers have also been defined by assessing the common farm level characteristics such as land, capital, exposure to risk, farm inputs and market orientation (Chamberlin, 2008). Dixon *et al*. (2001) explained that the term "smallholder" relates to limited resource endowment compared to other farmers. Ellis (1999) felt that smallholders are farming households that have limited access to land and rely on household labour for crop-livestock subsistence production. According to Shange (2014), some authors have defined a smallholder farmer by using farm size. For example, the World Bank (2003) defined a smallholder as a farmer with less than two hectares of agricultural land and a low farm resource base. According to Dent (1989), smallholder farms are defined as those smaller than the average farm size at a provincial or national level. However, farm size alone is not a good criterion for categorising farmers, because important factors such as quality of available resources, households' farm activities and managerial skills are not controlled by farm size (Ngemntu, 2010). According to Machingura (2007), these definitions have a similar theme and focus on basic farm level characteristics such as constraints to labour, agricultural land and other resources levels. According to Cousins (2012) and Ngemntu (2010), there is still no universally accepted definition of a smallholder, despite the clear-cut categories of farmers and the lack of quality data on smallholder agriculture have intensified the problem of defining a smallholder.

2.3 Characteristics of smallholder agriculture

Smallholder agriculture is characterised by a large number of rural households in mixed livestock- crop subsistence farming practices (Narayanan & Gulati, 2002). This relates to South Africa, where smallholder agriculture is characterised by a population of rural households in communal areas of the country with outdated farming technologies and unsustainably small plots of agricultural land, including the lack of technical farming skills and other farm services, in and/or out of the farm (Pote, 2008). Smallholder agriculture is further characterised by an environment with diverse economic activities which are farm or non-farm related (Alemu, 2012; Babatunde & Leliveld, 2012). According to Perret & Kirsten (2000), only 2.7% of the 70% rural households which participate in farm production rely on agriculture as a main source of household income. This has led to the majority of rural households deriving livelihood strategies from diverse income sources. These include agriculture, labour, trading and transfers. (Pote, 2008). The latter is in the form of social grants and remittances, which is known to form the backbone of South Africa's rural households (Nompozolo, 2000). According to Ellis (1998), this is considered a livelihood

diversification process, where a diverse set of household activities and social support capabilities are preferred for improved livelihoods. These diverse livelihood strategies are assumed to be conducive to opportunities and constraints for households in communal areas (Tittonell *et al*., 2010).

2.4 Role of smallholder agriculture in economic development

The smallholder agricultural sector plays an important role in South Africa's agricultural economy (Delgado, 1997). Its capability is of great importance in rural and economic development (Nothard *et al*., 2005). According to Ngemntu (2010), the significance of smallholder agriculture is recognised in the light of its role to the livelihoods of rural households through employment creation and poverty alleviation. Smallholder farmers continue to produce, in spite of the constraints, in order to satisfy a number of functions in the agricultural economy, which makes the agricultural sector important (Pote, 2008). The sector is also important for equitable distribution of income and linkage creation for economic growth (Rosset, 1999). According to Pote (2008), the government has also recognised the potential role of the sector towards poverty alleviation, employment creation and income generation.

2.4.1 Employment creation

The agricultural sector is recognised as an important sector in employment creation in developing countries (Delgado, 1997). According to Mhlaba & Brey (2014), smallholder farms have a great potential for creating meaningful employment for a large number of rural people, because they are more labour intensive than larger commercial farms, where mechanisation is used during farm production. Machethe (2004) stated that only effective participation in smallholder agricultural production is most likely to create meaningful employment.

2.4.2 Poverty alleviation

The type of farm support system surrounding smallholder farmers in the current institutional environment is ineffective in making an important contribution towards rural economic growth (Nothard *et al*., 2005). However, smallholder agriculture continues to fight rural poverty through its capacity to produce food, especially under proper farm support structures (Machethe, 2004). According to Pote (2008); Reardon & Barrett (2000), smallholder

agriculture contributes towards poverty alleviation through price reduction and own food production.

2.4.3 Improved household income

Smallholder farms allow own production (Dorosh & Haggblade, 2003). Less household income is thus spent on food purchases. Rosset (1999) is of the view that smallholder farms means more households have access to a piece of land where they can produce their own food. According to Baiphethi & Jacobs (2009), even though smallholder farmers derive a small proportion of their livelihoods directly from agriculture, the households that are able to produce their own food are considered better off in terms of household income compared to those who purchase food. Smallholders produce more for household consumption than for markets (Machethe, 2004). The households that are able to sell are constrained by limited access to markets, but those who can produce and supply markets are most likely to generate more income.

2.4.4 Linkages for economic growth

The growth of smallholder farms allows development of other business activities through forward and backward linkages (van Rooyen *et al*., 1995). For example, in areas where smallholder agriculture is effective, other non-farm economic activities arise as a result (Haggblade *et al*., 1990). Van Rooyen *et al*. (1995) explained that an increase in production as a result of an investment in one sector of the economy tends to encourage the demand for production resources from other sectors, which is called backward linkages. According to van Rooyen *et al*. (1995), initial production gains also increase incomes and spur consumer demand for other goods and services, which is referred to as forward linkages. According to Ngqangweni (1999), effective smallholder agriculture has a potential to create a demand for non-farm sector goods, where an increase in demand increases output in sectors where excess capacity exists.

2.5 Farming practices

Farming practices of smallholder agriculture are highly diversified, as they take the form of crop farming, livestock and/or mixed crop-livestock production (Ellis, 1998). According to Garrity *et al.* (2012), these farming practices are organised to produce food for household subsistence. In South Africa, farming practices normally range from large, capital-intensive production and processing units to extensive, labour-intensive subsistence agriculture

(Ngemntu, 2010). According to Ellis (1998), this mixture of farming practices forms part of a number of livelihood strategies of rural households. It is an excellent cushion to poverty in South Africa.

The capacity of an individual household to improve agricultural production depends on its capacity to adopt, adapt and manage farming practices, institutions and capital resources from internal and external sources (Enki *et al*., 2001). According to Mabuza (2009), the historical development of agriculture is analysed in three main categories, which include subsistence farming, diversified crop-livestock farming and commercial agriculture. Despite agricultural technology adoption and commercialization in developing countries, the majority of smallholder farmers are still subsistence producers, mostly engaged in mixed crop-livestock subsistence farming (Enki *et al*., 2001). However, a number of smallholder farmers are constantly shifting from subsistence to improved or diversified farming in order to create farm opportunities for increased agricultural production and to meet market demands (Chirwa & Matita, 2012).

2.5.1 Subsistence farming

Subsistence agriculture is a method of farm production where a small plot of land is used to produce just enough food to feed the household or small community working it, although a surplus is sometimes sold or traded in local markets (Ngemntu, 2010). According to Mabuza (2009), subsistence farmers are still using outdated farming tools. The cultivated area is often limited by factors such as effective farming tools and quality of agricultural land in the absence of advanced farming technologies (Baiphethi & Jacobs, 2009). According to Mabuza (2009) and Sibanda (2012), subsistence agriculture mostly consists of women smallholder farmers with limited rights to land, even though nearly all farming activities related to subsistence farming are performed by the same women who are denied credit by financial institutions. According to Mabuza (2009), men are the preferred beneficiaries of credit because they are the major holders of land title deeds or allocations. According to Bacou (2014), land tend to be used as collateral for loans or farm credit to provide a concrete basis for investment.

Land and labour are principal factors of production involved in subsistence agriculture (Mabuza, 2009). According to Manona (2005), subsistence farming is labour intensive and household members are used as the main labour force. This implies a limit to the amount of land that can be cultivated in a given production season (GRAIN, 2014). According to

Manona (2005); Todaro & Smith (2006), capital investment and land improvement are minimal in subsistence agriculture and most agricultural production improvements depends on external factors such as weather or rainfall. Despite the constraints facing smallholder farmers, the low production levels of subsistence agriculture is also subject to the lack of innovation and low levels of aspiration (Clifton & Wharton, 1969). According to Limbu (1999), social aspirations are desired future states, e.g. levels of living and social, education and employment status. Subsistence farmers are still attached to traditional values or a line of action established by their ancestors, which makes them respond with low levels of aspiration (Clifton & Whatson, 1969). According to Limbu (1999), smallholder farmers lack a strong drive for self-achievement, as they tend to be satisfied with just enough food and clothing from harvest to harvest. According to the FAO (2014), smallholder agricultural growth is retarded by lack of aspiration and farming resources, knowledge about farming improvements and insufficient incentives to drive such improvements. However, according to the USAID (2008), most subsistence farmers are inclined to better farming practices as they are willing to diversify farming practices, given the means and opportunities that do not contradict their belief system.

2.5.2 Diversified farming

Mixed crop-livestock agriculture is an adjustment to the farm enterprise production pattern (Dixon *et al*., 2001). According to Todaro & Smith (2006), diversified farming presents an integrated approach which allows diversification of households' farming activities and better distribution of labour throughout the year. The dominant livelihoods of diversified farming are livestock and crop production, which are integrated and managed in a closed homestead unit (Rota, 2010). Diversified farmers cultivate 10 or more crops in diverse mixtures that differ across soil types (IAC, 2004). They also keep a range of livestock. According to Mabuza (2009), diversified agriculture, particularly crop diversification has brought dramatic stability to agricultural production over the years. These livelihoods play an important role in rural economic growth and poverty alleviation (Todaro & Smith, 2006). According to Mabuza (2009), the success or failure of diversified farming to transform subsistence farming in South Africa depends on the social, commercial and institutional conditions under which farmers operate.

The farming technologies of diversified agriculture include labour-saving devices such as small tractors and mechanical farm implements or animal-drawn steel ploughs which have

been introduced to free manual labour for other farming activities (Kremen *et al*., 2012). This includes better farm inputs and simple irrigation, even though access remains limited to such inputs and farm credit (Todaro & Smith, 2006). According to the FAO (2001), although smallholder agriculture is striving for commercialisation, this has not stopped other farmers from using animal-drawn farming implements. According to Rota (2010), the use of animal power in diversified agriculture encourages crop-livestock integration and sustainable farming practices.

2.5.3 Commercial farming

Commercial agriculture represents the final and most advanced stage of individual holding in diversified farming and it is the most common type of agricultural practice in industrial nations (Mabuza, 2009). Its aim is to maximise agricultural production and profit margins through capital intensive production systems (Todaro & Smith, 2006). According to Kremen *et al*. (2012), commercial farms are larger than regular rural household farms because of economies of scale, which are necessary to remain competitive in the agribusiness. Unlike in subsistence agriculture, where there is limited access to capital resources and market for hired labour, commercial farms regularly employ outside help, particularly seasonal labour during the busiest times of the year such as planting and harvesting. Mabuza (2009) stated that the factors that differentiate commercial farming is the availability of hired labour and advanced farming expertise that create competitive advantage, which helps to maximise agricultural production and profit margins. The allocation of resources is thus determined by the profit motive rather than by the survival motive, where the unit of production is responsive to price and market signals (Mutabazi *et al*., 2013). Commercialisation is influenced by technical change (Todaro & Smith, 2006). Given the use of modern farming knowledge and access to credit, these farmers are geared to contribute to agricultural economy through improved farming, because in commercial agriculture modern tools mean new methods of farm production, which include product innovations such as seed varieties (Mutabazi *et al*., 2013 and USAID, 2008).

2.6 Smallholder farmers' resource levels

Smallholder farmers differ in terms of levels and types of available farming resources (Bacou, 2014). According to the FAO (2001), a smallholder farm system is a rural household and its resources and their interactions are at an individual farm level to safeguard the household's physical, social and economic welfare. In poorly resourced rural households, the

management of common resources is considered a practical approach towards local economic development (Todaro, 1989). A farm system is thus a typical natural resource management unit, with a complete range of economic activities such as on-farm, off-farm and non-farming activities (Dixon, Gulliver & Gibbon, 2001). However, smallholders continue to face the challenge of low levels of farm resources, e.g. land and capital (Njuki *et al*., 2013). Farmers with limited access to land have a lower capability to improve the scale of farm production because land is used as collateral for credit in order to provide a solid basis for investment (Bacou, 2014). Low resource levels is therefore a major issue for resource-poor farmers in the country (Sims, 1993).

Farmers' resource levels and other farm level characteristics outline the overall smallholder agricultural production which generates differential returns from various farming activities (Bacou, 2014). Farm level characteristics such as total land size, cultivated area, improved seeds and inorganic fertilizers have a significant influence on the overall agricultural production levels (Bacou, 2014). The main challenge is finding strategies to speed up agricultural production growth to meet food demands of the ever-growing population (Shields *et al*., 1993). According to Sibanda (2012), there is a need for gender-specific support systems to identify the different roles of household members in farm production and consumption. Njuki *et al*. (2013) added that women household heads are subjected to limited control over productive farming resources, especially land and credit, relative to men. This creates a gap that hinders intra-household bargaining power and access to a range of agricultural opportunities. Lessening the gender gap could generate positive outcomes for agricultural production and food security indicators (Sibanda, 2012). According to DAFF (2012), low resource levels in production factors such as agricultural land and capital assets have led to most farmers producing low quantities of agricultural produce that are of poor quality. Competent resource allocation occurs within a sustainable system, where all farmers are guaranteed fair access to local resources (Gemechis *et al*., 2012). Limited understanding of farmers' goals and resource limitations is thus an important factor affecting production (Somda *et al*., 2005).

The skewed distribution pattern of farming resources is noticeable in black communal areas where smallholder farmers are more vulnerable to crop failures than commercial farmers (Gemechis *et al*., 2012). The most productive farming resources are owned by only a small fraction of smallholder farmers (Ovuka & Ekbom, 1999). It is not surprising, therefore, that the majority of rural households derive their livelihood from off-farm activities, rather than

from agricultural production (Dunn, 2014). According to Dunn (2014), poor rural households rely on a wide range of activities to compensate their low household income. Income diversification has become common among rural households, where available resources are allocated across alternative livelihood activities such as crops, livestock and off-farm employment (Gemechis *et al*., 2012). According to Bacou (2014), smallholder farmers are not a homogeneous group. Their differences in resource levels, capabilities and behaviour cannot be well explained by the theory of cost minimisation and output maximisation, which is based on assumptions that farmers can either minimise the cost of production or maximise the total production.

2.7 Constraints to smallholder agricultural development

Smallholder farmers continue to face constraints which act as disincentives for increased agricultural production (Baloyi, 2010). According to Lyne (1996), Omamo (2005) and Pote (2008), the major constraints include limited access to agricultural land, markets, credit facilities, improved inputs, outdated farming technologies, poor farm infrastructure and extension services. According to the DBSA (1986), the most common constraints that are found in smallholder agriculture can be classified into two groups, namely external and internal constraints.

The DBSA (1986) explained that external constraints arise from a broader agricultural environment, which is largely beyond the control of an individual farmer, e.g. natural risks typical to farming activities, limited access to farm inputs, credit, mechanisation, poor farming services such as institutional, extension and infrastructural support, restrictive administrative, social structures and inappropriate policies and legislation, problems associated with land tenure and acquisition of agricultural resources. The DBSA (1986) defined internal production constraints as those that can affect farmers' capability to operate efficiently. According to Pote (2008), most farmers have some degree of control over constraints, such as shortage of labour, lack of farming knowledge and a range of cultural factors such as education, which in some instances tend to hinder effective farm management and proper allocation of resources. Ngemntu (2010) added that South Africa's smallholder farmers have little or no formal education, which limits them from making rational decisions in agricultural production. Poor access to the combination of these resources is considered to affect the way in which smallholder farmers benefit from agricultural opportunities such as

access to agricultural resources, farm services and adoption of improved farming practices (Bienabe *et al*., 2004).

2.7.1 Limited access to agricultural land

Land is an important farm resource which plays a significant role in agricultural production (Baloyi, 2010). Access to land has a positive influence on farmers' incentives to produce (Mabuza, 2009). Most of the decisions made by farming households are influenced by land holdings, especially when it is complemented by other farming resources such as credit and inputs (Baloyi, 2010). According to Ortmann & King (2006), individual rural households barely own land, especially women smallholders. Most of these farmers have access to unsustainable small plots of communal land, with little investment in irrigation and farm inputs (Awoke & Okorji, 2004). Improved access to land is important because rural households have unsustainably small plots of land (Koo, 2014). Aliber & Hall (2012) state that limited access to land remains a constraint. It has been the most debated issue in smallholder farming.

2.7.2 Traditional farming technologies

Smallholder agriculture is considered a low farm production activity in South Africa because of its simple, outdated farming technologies and low-return agricultural production systems (DAFF, 2012). Limited access to improved farming technologies, which include inorganic fertilizers, hybrid seeds, irrigation systems, small-scale mechanization, e.g. tractors and other improved farming assets continue to predominate in smallholder agriculture (Koo, 2014 and Aina, 2007). Improved farming technologies are keys to a vibrant smallholder agriculture and to national food security (Koo, 2014). However, poor rural households in South Africa do not benefit much from improved farming technologies, because they cannot afford them in required quantities, e.g. seeds and fertilizers (Minot & Ngigi, 2003). Limited adoption of modern farming technologies whose benefits are not well demonstrated within smallholder agriculture remain a major constraint affecting smallholder production levels (Hogset, 2005 and Somda *et al*., 2005). According to Njuki *et al*. (2013), credit constraints and uneducated older farmers with lack of technical skills, financial ability and innovative ideas towards smallholder development are contributing factors towards limited adoption of modern farming technologies.

2.7.3 Limited access to affordable credit

Smallholder farmers continue to face limited access to credit from financial institutions (Sibanda, 2012). According to Pienaar (2003), smallholder farmers are often avoided or turned down by commercial and national development banks, including formal micro-credit institutions, because of the lack of collateral. According to Salami *et al*. (2010), the share of commercial banks' loans to smallholder agriculture has been very low compared to manufacturing, trade and other service sectors. This has delayed technology adoption and desired expansion in smallholder agriculture. Although micro-finance institutions have taken financial services to millions of previously un-bankable smallholder farmers, they still have not reached the majority poorer rural households whose livelihoods are usually characterised by seasonal investments, risks and low returns (Peacock *et al*., 2004). In Kenya, limited access to affordable credit is considered a leading factor that has led to low agricultural production, while in Uganda, high interest rates have been proven to inhibit most agricultural investment (Salami *et al*. (2010). In South Africa, smallholder farmers depends on savings from low household incomes for investment in agriculture. This limits opportunities for agricultural growth (Baloyi, 2010). Fan & Chan-Kang (2003) noted that smallholder farmers also depend on remittances and informal money lenders in order to properly finance most agricultural activities.

2.7.4 Ineffective farm extension services

Extension support has disintegrated and been ineffective for some technological transformation to take effect in smallholder agriculture (Karugia *et al*., 2009). In Ethiopia, the focus has been on smallholder agricultural growth through improved access to modern farming inputs such as purchased seeds and fertilizer, even though delivery systems have not performed as expected, which caused delays in the procurement and the distribution of required inputs (Salami *et al*., 2010). According to Pote (2008), the effectiveness of farm extension has declined throughout the 1990s because of poor farm training and extension models followed in smallholder agriculture, delayed adoption of alternative models and a sharp decline in the operational budgets of the sector ministries. Daniel (2013) state that in Tanzania, farm extension support is centred on increasing farm production through short-term technical packages, which pay less attention to farmers' circumstances and sustainability at a household level. This indicates that the linkages between intensive research, extension and farm training are weak.

2.7.5 Limited access to formal markets

The majority of smallholders are situated in rural areas where there are no formal markets or agro-processing industries. As a result, they are often forced to sell their produce to local informal markets, sometimes at a lower price, or to transport them to towns at a higher cost (Timmer, 1997). Pienaar (2003) noted that some of these farmers do not even attempt to participate in formal markets after producing a marketable produce or surplus. Makhura (2001) pointed out that very few smallholders participate in formal markets in South Africa because of small marketable surpluses which do not attract formal markets or adhere to required quantity and quality standards. Further barriers to formal market access include the lack of economies of scale and reliable marketing information about potential markets and failure to negotiate prices for produce (Fan & Chan-Kang, 2003). Improved access to formal markets is required for transformation of smallholder farming towards commercially oriented farming (Pienaar, 2003).

2.8 Techniques for constraint identification and analyses

The purpose of constraint analysis is to identify the binding constraints to rural economic growth, which are the most severe sources that deter rural households from managing a productive farm that would significantly improve agricultural production (MCC, 2013). Pote (2008) state that constraint identification and analysis is focused on identifying, quantifying and conducting sensitivity analysis on the influence of technical and economic factors and/or farm level characteristics on farm production and future prospects for a vibrant smallholder agriculture. The constraints facing smallholder farmers have recently attracted the attention of Bacou (2014); Bediako *et al*. (2007); Mabuza (2009); Maliwichi, *et al*. (2014); Ngemntu (2010); Pote (2008) and Shange (2014). A number of studies have therefore contributed to a growing body of knowledge on the important matters that are facing smallholder farmers in developing countries. Several econometric models have been developed, modified and adopted by a number of disciplines in order to identify and analyse the production constraints facing smallholder farmers and their influence on agricultural production. However, there is still a research gap in terms of analysis and identification of the specific factors that influence the production constraints and farmers' choice of farming practices at a household level. The following sections discuss how production constraints have been identified and modelled in several studies.

2.8.1 Measuring constraints facing smallholder farmers

This section gives an overview of the empirical techniques that have been adopted and used to identify and analyse the factors influencing the production constraints facing smallholder farmers. According to Hazell *et al*. (2007) and the World Bank (2003), a large body of literature has analysed smallholder farmers' productive capacity in the face of interrelated farm level characteristics such as limited access to markets, farm infrastructure, farming technologies and agricultural resources. According to Duflo *et al*. (2011), these constraints are assumed to persist because of a wide research gap between the identified constraints and the actual factors influencing them. The Tobit model has been constantly used as an analytical tool in analysing the factors influencing various constraints in smallholder agriculture. Mussa *et al*. (2012) used the Tobit model to analyse resource use efficiencies in smallholder mixed crop-livestock farming, while Baiyegunhi & Fraser (2014) used the same model to analyse the important factors influencing the incidence of poverty among smallholders. The Tobit model is preferred because it follows the concept of maximum likelihood. This makes it a better choice to estimate regression coefficients, especially when the dependent variable is censored at both sides (Chu *et al*., 2010). According to Baiyegunhi & Fraser (2014) and Mussa *et al*. (2012), if the data contain values of the dependent variable that is censored, OLS is considered no longer relevant to the concept of estimated regression coefficients.

The other techniques that have been used in measuring the production constraints in smallholder agriculture include descriptive statistics. This technique is rarely used as a main analytical tool, except when describing the farm level characteristics or socio-economic factors of sampled respondents. Ngemntu (2010) successfully employed descriptive statistics directly, to investigate the significance of production constraints and the role of extension services on the productivity of smallholder farmers. A later technique of interest that has also been frequently used for grouping or clustering purposes is the Principal Component Analysis (PCA). Darroch & Muchayanyama (2006) used this tool to identify three valid institutional principal components of production constraints and two valid farm level dimensions, while Iyai *et al.* (2012) used PCA for clustering analysis and grouping of constraints as Principal Components (PCs) during a study on clustering and Principal Component Analysis of constraints in smallholder pig-keeping systems. Mudombi-Rusinamhodzi *et al*. (2012) further demonstrated the suitability of PCA for identifying and narrowing the list of variables into core uncorrelated factors and perceptions on responsiveness when analysing the factors

affecting smallholder farmers' responsiveness to climate variability induced hazards in Zimbabwe.

2.8.2 Measuring farmers' choice of farming practices

This section gives an overview of the empirical techniques that have been used in identifying and analysing the factors influencing farmers' choice of farming practices. The multinomial logistic (MNL) model has always been used in analysing and identifying smallholder farming practices. For example, Ayuya *et al*. (2012) successfully employed the MNL model to analyse the factors influencing choice of Organic Soil Management Practices among maize farmers. In contrast to the binary probit or logit models that are limited to a maximum of two choice categories, the MNL model is mostly preferred because it permits analysis of decisions across more than two categories in the dependent variable (Maddala, 1983). Ojo *et al*. (2013) used the MNL model to analyse the factors influencing the choice of enterprise among smallholder farmers producing yam and cassava. Jariko (2011) further demonstrated the suitability of the MNL model in the study involving nominal response variables with more than two categories when analysing the factors affecting farmers' adoption of sunflower varieties. Tamirat (2013) used this tool to analyse the tactical activity choice among clients of micro finance institutions. These models will also be revised and adopted in this study, where applicable.

2.9 Summary

This chapter gave a broad overview of South Africa's smallholder agriculture. The chapter began with a definition of a smallholder, followed by a background and characterisation of South Africa's smallholder agriculture and its potential role in livelihood creation of rural households. Farming practices were highlighted, followed by evaluation of smallholder farmers' resource levels. The chapter revealed several constraints and their influence on smallholder agricultural production. These included limited access to land, traditional farming technologies, limited access to affordable credit, ineffective farm extension support and limited access to formal markets. These constraints were reviewed with emphasis on farming as a livelihood strategy. Finally, the chapter reviewed a number of approaches for the analysis of constraints and choice of farming practices, including other analytical approaches that have been adopted for clustering constraints as dimensions or principal components. The Tobit model seemed to be the most dominant econometric model for analysing the significance of factors influencing the constraints in smallholder agriculture, while the

multinomial logistic (MNL) model was considered the main econometric model for analysing choice of farming practices. The identification of farm level characteristics and their influence on constraints and choice of farming practices were mostly guided by relevant studies. The chapter concluded that smallholder agriculture plays an integral role in the country's economy, in terms of rural and economic development perspective. Its significance is recognised in the light of its continuous contribution to the livelihoods of poor rural households in South Africa through poverty alleviation, employment creation and linkages for economic growth.

CHAPTER 3

CONSTRAINTS TO SMALLHOLDER FARMERS' AGRICULTURAL PRODUCTION IN KWAZULU-NATAL PROVINCE, SOUTH AFRICA

Abstract

The agricultural sector continues to stimulate economic growth for developing economies. This phenomenon relates to South Africa, where agriculture plays an important role in livelihood creation and development in the country's rural areas. However, rural households derive only a small proportion of their livelihood directly from agriculture because of production constraints. This study examined the factors influencing the constraints smallholders faced and their effects on farm production in KwaZulu-Natal province. It is an attempt to determine whether or not smallholder agriculture can significantly contribute to rural economic growth in South Africa. Data were drawn from a sample of 400 households in Ndwedwe and Umzimkhulu Local Municipalities in KwaZulu-Natal over one-month period using a structured questionnaire. Farmers were selected using a multistage randomised sampling method and descriptive statistics were used to describe farm level characteristics. Principal Component Analysis (PCA) was used to identify and transform a set of inter-related variables into core uncorrelated components. The Tobit model was used to examine the factors influencing the constraints faced by smallholders and their effects on farm production in KwaZulu-Natal.

PCA identified three Principal Components (PCs) of production constraints in sampled rural households in KZN. The findings of the study indicated that smallholders faced limited access to agricultural land and farm services in and/or out of the farm. The estimated Tobit model revealed that the identified constraints were statistically and significantly influenced by education level, marital status and gender of the household head, cultivated area, field condition, farm activities, farm assets and mixed fertilizer. The study concluded that smallholders seek effective farm support opportunities to improve farm production and their livelihoods. It recommends that, given the constraints, strategic measures to improve access to land and farm services should be instigated jointly to allow farmers to improve their farming practices.

Keywords: Smallholders, households, livelihoods, constraints, farm production, economic growth, PCA, Tobit.

3.1 Introduction

South Africa's rural households are made up of disadvantaged black farmers who are faced with a number of constraints (FAO, 2000). These households constitute about 78% of the country's smallholder farmers who depend, either directly or indirectly, on land for their livelihood (Wiggins *et al*., 2010). However, smallholder agriculture is considered a low agricultural production activity in South Africa, because of its fairly simple, outdated farming technologies and low-return production systems (DAFF, 2012). The sector has not yet fulfilled the fundamental role that it is expected to play in South Africa, as poverty remains a major concern in communal areas of the country (Mudhara, 2010). Mudhara (2010) further reasoned that many rural households continue to derive a small proportion of their livelihood directly from agriculture, which is probably the main cause of poverty-related issues in communal areas. The production constraints in the smallholder agricultural sector are considered a major cause of the continuous struggle of smallholder farmers in achieving increase agricultural production in South Africa (Mlengana, 2012). Even though the South African Agricultural Production Plan strives to improve national food security and agricultural economic production in a profitable and sustainable manner through rural economic growth, the limited increase in smallholder agricultural production has prevented smallholder farmers from making a meaningful contribution to economic growth in the country (DAFF, 2012).

South Africa's smallholder agriculture is saddled with production constraints such as limited access to agricultural land, farm credit, outdated farming technologies, ineffective farm extension, poor farm infrastructure, high input prices and limited access to formal markets (Mlengana, 2012 and Pote, 2008). The limited accessibility of yield-enhancing agricultural inputs, such as inorganic fertilizers, improved seed varieties, crop protection inputs remains an issue in smallholder agriculture (Ortmann & King, 2006). The majority of smallholder rural households have limited or no access to improved farm inputs which are required to improve agricultural production (Samarth, 2012). The lack of farming skills is also common among South Africa's smallholder farmers because of poor farm extension that should disseminate information about farming practices, produce prices and potential markets (Mahabile *et al*., 2002).

These production constraints act as disincentives for increased smallholder agricultural production (Baloyi, 2010). According to Minot & Ngigi (2003), this has constrained the

majority of smallholders from operating a productive farm and, as a result, smallholder agricultural production remains relatively low, despite government's attempts to assistant farmers, such as subsidising farm inputs. However, smallholder agriculture remains a dominant sector in communal areas of most developing countries, despite the constraints smallholder farmers face in agricultural production (Perdeson, 2003). According to Ortmann & King (2006), these farmers continue to produce certain quantities of farm produce from own production for household subsistence, while others are also able to supply local markets with surplus. Smallholder agriculture is also considered significant as a main employer of the rural poor, including women, in poverty-stricken rural areas of most developing countries (DAFF, 2012).

3.2 Households' farm level characteristics

Each and every household has its own specific farm level characteristics which arise from differences in resource endowments and household circumstances (Dixon *et al*., 2001). The farm level characteristics are considered to outline the overall farm resource levels of the sector, which generates differential returns from various agricultural production activities (Schnitzer *et al*., 2014). The specific farm level characteristics, such as land tenure, farm assets, total land size, cultivated area and irrigation system, have significant influence on agricultural production levels through adopted choice of farming practices, input use and market participation (Lahiff & Cousins, 2005). The other common farm level characteristics of production systems in smallholder agriculture relates to household size, age, education level, marital status and gender of the household head, simple and outdated farming technologies, low returns and a large number of women participating in farming activities (DAFF, 2011). Also included are poor remuneration packages, unemployment, poverty and hunger among rural households (Mudhara, 2010). Limited access to land is considered a major factor preventing the transition of smallholder farmers from subsistence farming to commercially-oriented agriculture, while the gender of the household head is considered an important factor that has a significant influence on a household's livelihood strategies (Schnitzer *et al*., 2014).

The actual farming system, household strategies and behaviour livelihood pattern of smallholder farmers are determined by resource endowments (DAFF, 2011). Land-based farming activities, e.g. cropping, livestock or harvesting of common property resources, have become an integral part of smallholder farmers' livelihood strategies, while diversity is

considered the most common socio-demographic characteristic of livelihoods among the majority of rural households in South Africa (Lahiff & Cousins, 2005). These typical farm level characteristics and agricultural production constraints are also prevalent among smallholder farmers in KwaZulu-Natal province. It is important to note that rural households constitute more than half of the national population of smallholder farmers who are involved in a number of agricultural production activities (FAO, 2000). These farmers make a significant contribution to the agricultural economy in one way or another. The aim of this study was to consider the farm level characteristics of smallholders in KZN in order to identify and analyse the factors influencing the constraints they face and their effects on farm production.

3.3 Methodology

This section describe the research methodology used in assessing and identifying the determinants of constraints in sampled rural households of KwaZulu-Natal. The section presents a detailed description of the study area, data collection, sampling technique, model variables and data analytical procedures. The resulting data was utilised for different levels of statistical analysis. Descriptive statistics, PCA and a Tobit regression model are presented in this section.

3.3.1 Study area

The study was undertaken in two Local Municipalities (LM), namely Ndwedwe and Umzimkhulu. Ndwedwe is in the Ilembe District Municipality (DM), while Umzimkhulu is in the Sisonke DM in KwaZulu-Natal (KZN) province of South Africa. KZN is situated in the south-eastern part of the country (Fig. 3.1, page 27). It is home to about 21% of South Africa's population (National Survey, 2011). According to Statistics SA (2011), KZN is the largest province in South Africa, with a large rural population and a growing manufacturing sector. The province has relatively high potential for a number of agricultural production activities because of its favourable climate, fertile soil and access to water for irrigation (Sikwela, 2013).

Ndwedwe LM is 60 km north of Durban and about 20 km west-north-west to the coast of KZN. Ndwedwe LM extends over 1 076 km^2, with commercial agriculture in the north-eastern side. The rest of the area consists of subsistence farming. Ndwedwe is thus made up of poor black rural households whose livelihood depends on subsistence farming practices (Stats SA, 2012). The type of farming system in the area can be characterised as mixed crop

and livestock subsistence agriculture, with livestock such as cattle, goats and sheep, including a selection of crops such as maize, madumbes, sweet potatoes and groundnuts (Sotshongaye & Moller, 2000).

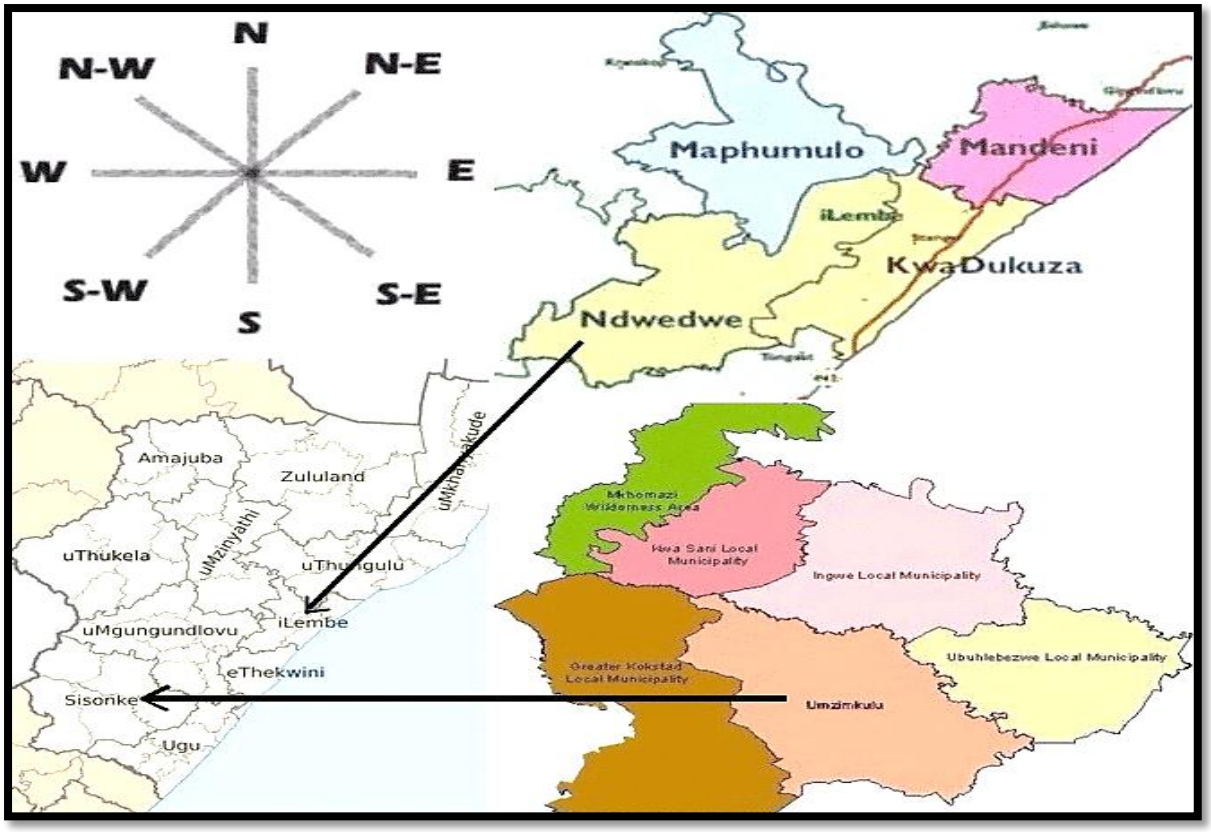

Figure 3.1: Umzimkhulu and Ndwedwe local municipalities within KwaZulu-Natal province of South Africa

Source: Google Maps (2015)

Umzimkhulu LM is 243 km northeast of Mthatha and 18 km southwest of Ixopo (30.263°S 29.940°E). This LM has a population of about 180 302 people. It consist mostly of rural households which are still lacking in basic social services such as housing, electricity, health-care, running water and poor road infrastructure, which provides only limited access to most areas (Stats SA, 2011). The most common livelihood activities in Umzimkhulu LM involves several crops and livestock agricultural production activities from diversified subsistence farming practices.

3.3.2 Data collection

Data was collected over one-month period from Mid-March to Mid-April 2015, using five enumerators who speak the local isiZulu language. The enumerators attended a training session before pre-testing. The one-day training was focused on the content of the questionnaire. The questionnaire was pre-tested and later adjusted, using insights from pre-testing, before embarking on the actual data collection. The researcher made all the required arrangements with relevant authorities from the Department of Agriculture and Rural Development in both LMs, prior to data collection. Extension Officers were allocated from each area to assist with establishment of contact with sampled farmers' households. Data collection followed shortly after pre-testing, through household surveys using a detailed and structured questionnaire to generate primary data. Secondary data was generated from the documented information in relevant books, electronic articles in scholarly journals and other research sources.

Rural households represented a sampling unit in this study, whereby the household head was interviewed as a key respondent. Rosenthal & Marshall (1987) defined a "household head" as a term commonly used to describe an individual with the authority to exercise household control within a household setting and provide support and maintenance to dependent members who are related to him or her. The term is used to cover a number of concepts such as employment status, household income or livelihood activities, but it often refers to a main economic provider and decision-maker within the household (Hedman *et al*., 1996). The household head thus reflects the stereotype of an authority position within the ancestry or a bread-winner in the household. Where the household head was absent, a household member responsible for household livelihood activities, such as farming, was interviewed on behalf of the household head.

3.3.3 Sampling procedure

The study adopted a multi-stage randomised sampling technique in selecting 400 targeted individual smallholder households involved in crop and/or livestock production activities in KwaZulu-Natal province. Multi-stage sampling is a sampling technique that is done successively in stages using smaller and smaller units at each stage or a target population of elements called Principal Sampling Units (PSUs) (Battaglia, 2008). The multi-stage randomised sampling technique was mainly adopted for its practicality and cost-effective reasons. For example, to select a Simple Random Sample (SRS) of individual smallholder

rural households in KwaZulu-Natal would have been difficult and costly because no specific list of all individual rural households exists. Thus we had to proceed in stages as follows: an SRS of all wards in KZN, an SRS of villages within each ward and an SRS of individual rural households within each village. Thus, 300 individual smallholder rural households were randomly selected from three wards and three villages in Ndwedwe, while 100 individual smallholder rural households were randomly selected from two wards and three villages in Umzimkhulu research area. This made a total sample size of 400 individual smallholder farmers' households.

3.3.4 Data analysis

The data was analysed using both SPSS and STATA statistical software packages. SPSS was used for generating descriptive statistics and PCA, while STATA was used for Tobit regression analysis. Descriptive statistics were used to examine the farm level characteristics of sampled households and PCA was used to identify and transform a set of inter-related variables into core uncorrelated components. The Principal Components (PCs) were then used in a Tobit regression model to examine and identify the factors influencing the constraints faced by smallholders and their effects on agricultural production in KwaZulu-Natal province.

3.3.5 Model specification

Principal Component Analysis (PCA) is a multivariate technique that transforms a set of correlated variables into smaller number of uncorrelated components with maximum variance (Manly, 2005). Stevens (1986) defined PCA as a useful variable reduction technique which is suitable when using data with a large number of observed variables and when the researcher wishes to develop a smaller number of artificial variables called Principal Components (PCs) that will account for most of the variance in the observed variables. The number of PCs extracted in a PCA is equal to the number of observed variables being analysed (Kim & Mueller, 1978). In most analyses, only the first few components account for meaningful amounts of the variance (Stevens, 1986). The decision about which of the PCs to retain depends on the percentage of the variation in the original variables accounted for by each PC (Koutsoyiannis, 1987).

The study began with the intention of using the 12 constraints in the questionnaire as 12 separate dependent variables in a Tobit regression model. However, according to Hatcher & Stepanski (1994), this approach could lead to problems such as redundancy, which means

that some of the variables could be correlated with one another, possibly because they are measuring the same construct. Thus, the 12 constraints were reduced to three smaller sets of uncorrelated PCs. Stevens (1986) defined a PC as a linear combination of optimally-weighted observed variables. The retained PCs were estimated as linear functions of the 12 production constraints as follows:

$$PC_i = a_{i1}X_1 + a_{12}X_2 + a_{i3}X_3 + \cdots + a_{i12}X_{12} \quad \ldots\ldots\ldots\

U_i =1, if $U_i^* \geq 1$

U_i =0, if $U_i^* \leq 0$, i = 1, 2 …n

Where i denotes the i^{th} household in the sample, U_i is PC representing the constraints faced by the i^{th} household. U_i^* is the latent variable, β_j are parameters of interest and μ_i is random error term that is independently and normally distributed with mean zero and common variance of σ^2 (μ_i~NI (0, σ^2)). Z_{ij} are farm level characteristics of sampled rural households in KwaZulu-Natal.

3.3.6 Explanatory variables used in the Tobit model and their *a priori* expectations

The important explanatory variables considered for the Tobit regression model are presented in Table 1.

Production constraint: This is a limited dependent variable. It represents the constraints faced by the sampled rural households in KZN. The dependent variable may be restricted to a binary choice, rather than being continuous on the real line, indicating that a particular course of action was not selected (Baum, 2013). This dependent variable is explained by a situation whereby smallholder farmers continue to derive a small proportion of their livelihoods directly from agriculture, due to a number of constraints. The perceived constraints are estimated to be significantly influenced by several farm level characteristics presented in Table 1.

Sikwela (2013) noted that smallholder farmers faced constraints in accessing farm services in and/or out of the farm. In this study, access to farm services was categorised by access to improved inputs, infrastructural support, produce markets, credit and extension. In addition to proper farm services, smallholders require access to land and support in setting up market information systems regarding prices and market demand, in order to pave the way to most farm services (Matsane & Oyekale, 2014). According to Pauw (2007), poverty alleviation can be achieved among rural households through farming if all farmers could have ease of access to agricultural land and farm services. Sikwela (2013) stated that emphasis on quality of produce could serve as a main source of sustainable competitive advantage in smallholder agriculture.

The existing theories on smallholder agricultural systems have been used in selecting 12 farm-level characteristics that are assumed to influence the constraints in smallholder agriculture (Table1).

Table 1: Description of key variables included in the Tobit model

Variable names	Description of the variables
Farm activities	Set of farming activities, 1 if livestock only; 2 if cropping only; 3 if mixed farming
Education level	Number of years of formal education of the household head
Age	Age of the household head (*years*)
Total land size	Total land size that the farmer has access to in hectares (*ha*)
Gender	Gender of the household head (*Dummy*): 1 if male; 0 if female
Cultivated area	Number of hectares cultivated during the 2014/15 production season
Marital status	Marital status of the household head, 1 if single; 2 if married
Household size	Number of household members who are active in farming activities (*over 12 years old*)
Farm assets	Dummy: 1 if the household had access to farm assets, 0 otherwise
Field condition	Current condition of the field or garden. 1 if fenced; 2 if partially fenced; 3 if not fenced
Family income	Gross value of monthly household income from agricultural production and other household income sources, e.g. pension, etc. (*R/ month*)
Mixed fertilizer	Dummy: 1 if the farmer mixed inorganic fertilizer with other sources of soil fertility during the 2014/15 season, 0 otherwise
Production constraints	**PC_1: Access to farm services out of the farm** **PC_2: Access to farm institutions on the farm** **PC_3: Access to agricultural land**

i) Marital status: This is a categorical variable, taking a value of 1 if the household head is married and 2 if single. According to Gobena (2012), marital status determines the stability of most families and there are very critical trends in marital status of household heads in African cultures. It is assumed that married household heads are more stable in farming activities than single household heads, which positively influences a household's production and marketing patterns (Musemwa *et al*., 2008). Married household heads are

expected to increase the likelihood of access to farm services and land more than single household heads.

ii) **Education level:** This is a continuous variable. It is the number of years of formal education of the household head. According to Marenya & Barrett (2011), education level relates to human capital and the ability of the household head to make thorough farming decisions. The study assumed that educated household heads are more capable of interpreting essential agricultural information. According to Monde (2007), educated farmers can utilise important agricultural production and marketing information, which consequently improves access to proper farm services such as markets, improved agricultural inputs and effective extension support. However, there is still a large number of uneducated smallholder farmers in developing countries with limited technological farming skills, financial ability and innovative ideas towards smallholder development (Njuki *et al*., 2013). Low education level is a major contributing factor towards limited adoption of advanced and productive farming practices in SA's smallholder agricultural systems. This variable is thus expected to negatively influence access to agricultural land and farm services.

iii) **Household size:** This is a continuous variable. It refers to the number of active household members over the age of 12 years who participated in households' farm activities. According to Bosch *et al*. (2002), the ILO Minimum Age Convention of 1973 states that children younger than the age of 15 years should not be allowed to participate in any kind of economic activities and, if they are over 12 years old, the work must be light and not affect their health or development. According to Gobena (2012) and Sikwela (2013), smallholder agriculture is labour intensive and requires a large labour supply. This becomes a problem because smallholders have a limited market for hired labour. Active household members thus become a source of labour. Even though smallholder agriculture is labour intensive, there is also light work in farm activities such as herding and feeding farm animals, which is often carried-out by younger household members. Household size is therefore expected to negatively influence access to land and farm services.

iv) **Gender:** This is a dummy variable, taking a value of 1 if the household head is male and 0 if female. The study assumed that male headed households have more exposure to farm resources such as land, farm services and advanced farming technologies than female

headed households. According to Sibanda (2012) and Mabuza (2009), in most developing countries men are often major holders of land title deeds or allocations than women, who still lack access to land rights. This allows men to often engage in productive farming practices. Male household head is taken as a reference variable and it is expected to positively influence access to land and farm services more than female household heads.

v) **Farm assets:** This is a dummy variable, taking a value of 1 if the household head had access to farm assets and 0 if not. In this study, farm assets refers to farm machinery and equipment such as tractors, ploughs, harrows, irrigation system, etc. According to Pote (2008), smallholder farmers have limited access to farm assets and those few famers with productive farm assets are considered relatively wealthy, with a capability to increase agricultural production. The present study assumed that the majority of rural households have limited access to improved farm assets, which have a negative influence on agricultural production. This variable is expected to negatively influence access to land and farm services.

vi) **Household income:** This is a continuous variable which represents the sum of income received by the household per month directly from farming, remittances, pension, etc. Poor rural households continue to derive a small proportion of income, especially from farming, because of constraints in smallholder agriculture (Baiphethi & Jacobs, 2009). According to Perret & Kirsten (2000), only 2.7% of the 70% rural households who participate in farming rely on agriculture as a source of household income. The household income is expected to negatively influence access to agricultural land and farm services.

vii) **Age:** This is a continuous variable. It is the number of years of the household head's age. The study assumed that young farmers perform better than old farmers in terms of economic potential and labour productivity. Younger farmers are more likely to invest and modernise farm holdings because they probably received farm training which enables them to make use of available agricultural opportunities to improve production (Baloyi, 2010). According to Sihlobo (2015), the average age of a farmer in South Africa is 62 years. The study assumed that there are few younger farmers in SA's communal areas with innovative ideas towards a vibrant smallholder agriculture sector. The age of

the household head is anticipated to negatively influence access to agricultural land and farm services.

viii) **Farm activities:** This is a categorical variable. It represent the types of households' farm activities performed during the 2014/15 production season. Smallholder agriculture is characterised as mixed crop-livestock subsistence agriculture, where crop and livestock production form part of major livelihood activities of farming households in communal areas (Pote, 2008). However, according to Sikwela (2013), there is still a need to diversify households' agricultural activities, in order to improve smallholder agricultural production. This variable is thus expected to reduce the likelihood of access to land and farm services.

ix) **Field condition:** This is a categorical variable. It represent the current physical condition of the field or homestead garden. Fences are used to keep animals in or out of farming areas in order to protect cultivated crops (Peden, 2012). The study assumed that fencing is important for protecting cultivated crops and managing livestock by keeping them from straying from one household to another. Farmers with properly fenced farming areas are more likely to access farm services because the land can be easily used for farming, without having to worry about potential damage to cultivated crops or unrestrained livestock. However, rural households have little capital to invest in proper farm infrastructure. The influence of this variable on access to land and farm services remains unknown.

x) **Total land size:** This is a continuous variable. It represent the total size of available land in hectares. According to Baloyi (2010), land is a main farm asset and most of the decisions made by farming households are highly influenced by the available total land size. According to Dent (1989), smallholder farms are defined as those smaller than the average farm size at a provincial or national level. Smallholder farmers often own and/or cultivate less than two hectares of land where they normally produce at least 10% of marketable produce through subsistence-based production systems (DAFF, 2012). The study assumed that an increase in total land size is most likely to increase the scale of agricultural production in communal areas. However, the majority of smallholder farmers in developing countries have unsustainably small plots of land for farming activities. This variable is expected to negatively influence access to agricultural land and farm services.

xi) **Cultivated area:** This is a continuous variable. It represents the cultivated area of land for crop production activities during the 2014/15 production season, in hectares. The study assumed that farm output is directly linked to cultivated area. According to Baiphethi & Jacobs (2009), the cultivated area is limited by factors such as availability of farm resources and quality of the soil, in the absence of advanced farming technologies. Even though the majority of rural households cultivate one or less hectares of land during a given production period, an increase in cultivated area is most likely to increase agricultural production, provided that it is complemented with effective farming resources. However, in the case of smallholders, fewer hectares of poor quality land are cultivated with limited access to agricultural support in terms of farm inputs and farm credit. The cultivated area is expected to negatively influence access to agricultural land and farm services.

xii) **Mixed fertilizer:** This is dummy variable, taking a value of 1 if the farmer mixed inorganic fertilizer with organic sources of soil fertility, 0 if not. Inorganic fertilizers are expensive and smallholders cannot afford them in required quantities (Pote, 2008). Over the years, the agribusiness industry has put aside smallholder farmers by incurring higher prices on improved farm inputs, e.g. inorganic fertilizers (Duflo *et al*., 2011). The majority of smallholder farmers would normally purchase small quantity of inorganic fertilizer and mix it with organic sources of soil fertility in order to increase the required quantity of fertilizer for crop production at the lowest possible cost. According to Swagata (2016), mixing inorganic fertilizer with organic sources of soil fertility can actually benefit a smallholder farmer by improving agricultural production at a lower cost. This variable is therefore expected to positively influence access to agricultural land and farm services.

3.4 Empirical results of the study

This section presents the results of the study in terms of frequencies and percentages through descriptive statistics, including PCA and empirical results obtained through Tobit regression analysis.

3.4.1 Descriptive statistics of farm level socio-economic characteristics

Descriptive statistics depicted average values of farm level characteristics related to demographic and socio-economic factors of sampled farmers' households in KwaZulu-Natal as a basis for understanding the population under analysis. Descriptive statistics of farm level

characteristics that were used to study the factors influencing the production constraints are presented in Table 2.

Table 2: Descriptive statistics of selected farm level characteristics (N=400)

Independent variables		**Mean**	
Continuous variables			
Education level (Years)		5.1	
Age (Years)		58.3	
Cultivated area (Ha)		1.0	
Total land size (Ha)		1.9	
Household income (R/month)		2393.38	
Household size	Number of active household members who are over the age of 12 years	5.6	
Categorical variables		**Response**	**%**
Research area(s)	The area where the study was conducted	Umzimkhulu	25.0
		Ndwedwe	75.0
Farm activities	Type of households' farming activities	1=Livestock farming	3.30
		2=Cropping	28.8
		3=Diverse activities	68.0
Marital status	Marital status of the household head	1=Single	38.2
		2=Married	61.9
Gender	Gender of the household head	1=Male	48.8
		0=Female	51.3
Farm condition	Current condition of the farm or garden	1=Fenced	28.3
		2=Partly fenced	20.3
		3=Not fenced	51.5
Farm assets	Access to farm assets	Yes	92.5
Mixed fertilizer	Mixed organic fertilizer with other sources of soil fertility during the 2014/15 season	Yes	55.3

3.4.2 Factors influencing smallholder farmers' production constraints

This section presents the results of the Principal Component Analysis and Tobit regression analysis.

3.4.2.1 Results of the Principal Component Analysis

PCA was used to identify and transform a set of inter-related variables into core uncorrelated components in order to find general clustering of constraints as PCs. PCA identified three PCs which were extracted from the covariance matrix using SPSS. The retained PCs explained 62% of the total variance (Table 3). According to Koutsoyiannis (1987), the retaining PCs that meet Kaiser's criterion have eigenvalues of one or more and component loadings greater than 0.3. The constraint variables were loaded in the PCs using varimax rotated component matrix and the component loadings greater than 0.50 were considered significant (Table 4).

Table 3: Number of extracted PCs, eigenvalues and variance explained

PCs	Eigenvalues	% of variance	Cumulative % of variance
PC_1	2.135	30.50	30.50
PC_2	1.158	16.55	47.05
PC_3	1.014	14.49	61.54

Table 4: Variables loaded in the PCs and component loadings

PCs	Loaded variables	Component loadings
PC_1: Access to farm services out of the farm	Access to produce markets	0.767
	Poor farm infrastructure	0.705
	Access to improved inputs	0.688
PC_2: Access to farm support institutions	Access to farming skills	0.750
	Access to credit facilities	0.676
	Access to farm extension	0.524
PC_3: Access to agricultural land	Access to agricultural land	0.973

PC_1 is named "Access to farm services out of the farm". This PC accounts for 30.50% of variance, with eigenvalue of 2.135 (Table 3). Three variables were loaded significantly into

this PC (Table 4). PC_1 is placed at the first priority of constraints facing smallholder farmers in KwaZulu-Natal.

PC_2 is named "Access to farm support institutions". This PC accounts for 17% of variance, with eigenvalue of 1.158 (Table 3). Three variables were loaded significantly into this PC (Table 4).

PC_3 is related to poor acquisition of land. It is named "Access to agricultural land" and contains only one variable (Table 4). PC_3 accounts for 14.49% of variance, with eigenvalue of 1.014 (Table 3).

3.4.2.2 Results of the Tobit regression analysis of the factors influencing smallholder farmers' production constraints

In order to identify the specific factors influencing smallholder farmers' production constraints in the sampled rural households of KwaZulu-Natal province, the three PCs representing the perceived production constraints were regressed separately on selected farm level characteristics (Table 1). The maximum likelihood estimates of the Tobit analysis are presented in Table 5.

The results of the Tobit regression analysis indicated that nine farm level characteristics are statistically significant in influencing smallholder farmers' agricultural production in sampled rural households in KwaZulu-Natal (Table 5). The marital status and gender of the household head, households' farm activities, farm assets and cultivated area are statistically significant and positively influencing smallholder farmers' access to agricultural land, while the field condition and education level of the household head are statistically significant and negatively influencing farmers' access to agricultural land. The estimated Tobit model also indicated that household's farm activities and mixed fertilizer are statistically significant and positively influencing smallholders' access to farm services, while household size, field condition and income are statistically significant but negatively influencing farmers' access to farm services.

3.5 Discussions

This section presents discussions of results obtained through descriptive statistics and Tobit regression analysis.

Table 5: Tobit regression estimates of determinants of constraints faced by smallholder farmers (N=400)

Independent variables	**PC_1**			**PC_2**			**PC_3**		
	β	**Std. E.**	**Sig.**	**β**	**Std. E.**	**Sig.**	**β**	**Std. E.**	**Sig.**
Household income	-0.074	0.104	ns	-0.004	0.001	ns	-0.073	0.101	ns
Cultivated area	0.020	0.076	ns	0.022	0.082	ns	0.131	0.075	*
Research area	-0.021	0.011	**	-0.020	0.115	ns	0.032	0.010	***
Farm activities	2.026	0.960	**	1.519	1.007	*	1.736	0.939	*
Age	-0.001	0.004	ns	0.002	0.005	ns	0.004	0.004	ns
Field condition	-0.301	0.067	***	-0.034	0.062	ns	-0.137	0.066	*
Farm assets	-0.345	0.433	ns	0.031	0.450	ns	0.727	0.424	*
Household size	-0.043	0.025	*	0.016	0.026	ns	-0.009	0.024	ns
Gender	-0.161	0.106	ns	-0.039	0.112	ns	0.309	0.103	***
Education level	0.001	0.014	ns	0.003	0.019	ns	-0.139	0.011	***
Marital status	-0.077	0.047	ns	0.035	0.053	ns	0.117	0.046	**
Total land size	-0.038	0.062	ns	-0.066	0.096	ns	-0.057	0.061	ns
Mixed fertilizer	-0.174	0.109	ns	0.341	0.188	*	0.112	0.106	ns
Constant	1.688	0.595	***	-0.627	0.662	ns	-0.618	0.582	ns
Log Likelihood	-544.68						-535.936		

***, **, *: significance of coefficient at 1%, 5% and 10% level, respectively; ns: not significant

3.5.1 Household's farm level and socio-economic characteristics

On average, the survey households were headed by a 58-year-old married female, with at least five years of formal education (Table 2). This indicates that smallholder agriculture was dominated by older women household heads, with a minimum level of education in sampled rural households of KwaZulu-Natal province. According to Sibanda (2012), women smallholders constitute about 60-70% of all farmers in developing countries and a farming programme that exclude them is bound to have a limited and short-term effect on the overall agricultural production. However, according to Baiyegunhi & Fraser (2014), male-headed households have more exposure and control over essential agricultural production resources than women, e.g. agricultural land, which allows them to easily acquire access to farm services. The study assumed that young farmers perform better than old farmers in terms of labour productivity and economic potential. According to Baloyi (2010), young farmers are most likely to have received farm training that enables them to make use of available farming opportunities.

The average level of five years of formal education is low. According to Marenya & Barrett (2011), education level relates to human capital and the ability to make thorough farming decisions. The study assumed that educated household heads can better utilise agricultural production and marketing information, which improves access to proper farm services such as farm extension support, improved farm inputs and formal markets. According to Sikwela (2013), educated farmers are more capable of interpreting agricultural information and taking advantage of farming opportunities. Sikwela (2013) added that these farmers are also more willing to test and adopt productive farming practices, which consequently improve farm production. This level of education does not, therefore present a strong capability for smallholders to access farm services or benefit from agricultural opportunities such as land redistribution.

The results indicated that the majority of survey households were married (Table 2). The marital status determines the stability of households in farming (Gobena, 2012). According to Gobena (2012) and Musemwa *et al*. (2008), married household heads are more stable in agricultural production than single-headed households, which has a significant effect on agricultural production and marketing patterns of the household. The surveyed households consisted of six active household members over the age of 12 years who participated in various farming activities (Table 2). Smallholder agriculture has high labour requirements

(Gobena, 2012). Active household members are thus the main source of labour in communal areas because of the limited market supply for hired labour (Sikwela, 2013). The average household size of six active members is small, because it is not complemented by effective farm resources.

The results of descriptive statistics indicated that one hectare of land was cultivated from a total land size of two hectares, which is consistent with other studies on land size of smallholders (Table 2). Land is an important farm asset and most of the decisions that are related to farming are highly influenced by land holding size (Baloyi, 2010). The present study assumed that farm output is directly linked to cultivated area and farmers with more land are most likely to increase the scale of production. Table 2 showed that 68% of farmers were involved in diversified farming activities, which are characterised as mixed subsistence farming (Enki *et al*., 2001). An average total land size of two hectares is small for mixed farming, which could lower production and access to farm services by constraining farmers from producing enough to supply the markets. Even though most rural households cultivate one or less hectares of land during a given production period, the study assumed that an increase in cultivated area is most likely to increase the likelihood of smallholders' access to farm services.

The average household income of R2393.38 per month is low. Even though the relative impact of poverty levels varies between countries, about 70% of total world poverty is found in rural areas, where a total of 1.2 billion people live in poverty (Dixon *et al*., 2001). Hunger is an individual problem that is associated with distribution of food and income within countries (Norton *et al*., 2010). Norton *et al*. (2010) added that, even though the percentage of the world's population living on less than $1/day is now less than 20%, there is still more to be done to alleviate rural poverty. The surveyed households had limited income to cover basic household needs and to invest in agriculture, such as maintaining the conditions of farming areas.

The results presented Table 2 showed that 52% of the available land was not fenced, which is probably because most smallholders rely on low household income to invest in farm infrastructure, due to limited access to farm credit (Sikwela, 2013). The households with unfenced farming areas were mostly found in the Ndwedwe. This is probably because in Ndwedwe they have strict rules about farm animals straying around farming areas, which is not always the case in Umzimkhulu. In Ndwedwe, farm animals such as cattle, sheep and

goats are herded towards the mountains every morning, where they are allowed to graze freely in unpopulated bush areas and herded back in the afternoon. Most of the surveyed households in Ndwedwe were therefore not affected by stray farm animals, except wild pests from nearby forests.

The majority of households in the survey had access to farm assets such as machinery and equipment, even though they were fairly outdated (Table 2). Smallholder agriculture is characterised by the low use of productive farm resources (DAFF, 2012). Smallholders still make use of simple farm tools, e.g. hoes, machetes, fork spades and outdated farming methods such as manual weeding and hoeing, which constrain farmers from engaging in productive farming practices. Descriptive statistics showed that the surveyed households mixed fertilizer during the 2014/15 season. Rural households often mix fertilizer in order to avoid a high cost of using inorganic fertilizer alone. Smallholder farmers cannot afford inorganic fertilizers and animal manure or compost is bulky and difficult to obtain in required quantities (Odhiambo & Magandini, 2008). The immediate need is basic support in the form of improved farm inputs, such as inorganic fertilizers, in order to improve smallholder farm production. According to Swagata (2016), mixed fertilizer is often linked with higher yield per hectare at lower cost, which enables farmers to become less vulnerable to crop failures and food shortages.

3.5.2 Factors influencing smallholder farmers' production constraints

The estimated Tobit regression model identified nine factors that are statistically and significantly influencing the constraints to agricultural production among sampled rural households in KZN (Table 5). The results in Table 5 showed that households' farm activities are statistically significant and positively influencing access to farm services and agricultural land. This implies that the likelihood of access to agricultural land and farm services will increase with increasing households' farm activities. This is consistent with the *a priori* expectations of the study. The surveyed households were involved in mixed crop-livestock production. This is an adjustment to the farm enterprise pattern to improve agricultural production through an integrated approach which allows diversification of farm activities (Dixon *et al*., 2005). According to Todaro & Smith (2006), diversified farming practices often lead to an increase in farm production, which consequently improve access to farm services such as produce markets and further present a strong capability for smallholders to acquire more land. However, the majority of smallholder farmers in developing countries are

still lacking effective crop-livestock diversification skills, which reduce the likelihood to access more land for diversification or access to markets because they lack the capability to improve agricultural production (Sikwela, 2013). This consequently reduce the odds to supply the markets.

The results of the Tobit model indicated that mixed fertilizer is statistically significant and positively influencing access to farm services, which implies that the likelihood of access to farm services will increase with increase in mixed fertilizer usage. This is consistent with the *a priori* expectations of the study. Descriptive statistics indicated that about 55% of the surveyed households mixed fertilizer during the 2014/15 season. Most smallholder farmers have limited access to inorganic fertiliser in correct quantities because of farm credit constraints. However, according to Swagata (2016), mixing inorganic fertilizer with organic sources of soil fertility, such as animal manure and composts can improve farm production at a lower cost. The use of mixed fertilizer can lead to higher agricultural production, which consequently improves access to farm services where farming households can produce enough food for household consumption and further supply the markets at lowest possible costs. Continuous access to markets can also encourage and improve access to other farm services such as physical farm infrastructure, access to credit facilities, extension support and better farm inputs, which could positively influence the households' production and marketing patterns.

The farm-level characteristics, which included field condition, household size and income are statistically significant but negatively influencing access to farm services. This implies that the likelihood of access to farm services will decrease with increasing household size, field condition and household income. Descriptive statistics indicated that 52% of the fields were unfenced, mainly in Ndwedwe. According to Peden (2012), smallholder farmers have limited capital to make proper improvements on physical conditions of the farm. This reduces the likelihood of access to farm services, because poorly maintained farm areas reduce the value of land that can be used as collateral to acquire services such as farm credit, to provide a solid basis for investment. Descriptive statistics indicated that the surveyed households had an average of six active household members and an average household income of R2393.38 per month. The household size of six members is small and reduces the likelihood of access to a number of farm services, because smallholder agriculture is labour intensive, with limited market for hired labour which is required to increase the scale of farm production in order to access markets and credit facilities (Sikwela, 2013). Rural households thus derive a small

proportion of their household income, especially from agriculture. Only 2.7% of the 70% rural households who participate in agriculture rely on it as a main source of income (Baiphethi & Jacobs, 2009; Perret & Kirsten, 2000). The surveyed households had limited income to invest in agricultural production activities, which reduced the likelihood of access to farm services.

The results of the estimated Tobit model further indicated that the likelihood of access to agricultural land will increase with increasing cultivated area, farm assets, gender and marital status of the household head (Table 5). The surveyed households cultivated one hectare of land during the 2014/15 season. According to Baiphethi & Jacobs (2009), the cultivated area is limited by factors such as the quality of the soil and accessibility of effective farm inputs such as fertilisers and improved seeds. This is not consistent with the *a priori* expectations of the study. However, even though rural households cultivate one or fewer hectares of land during a given production period, an increase in cultivated area is most likely to increase agricultural production, especially in the presence of effective farm inputs. It also shows a strong capability to increase the scale of farm production and a need for access to more land. The surveyed households had access to assets during the 2014/15 season. The study expected farm assets to reduce the likelihood of access to agricultural land, because even though smallholders have production assets, they are outdated tools such as hoe, machetes, forks spades, together with outdated farm methods, e.g. manual weeding and hoeing. Smallholder agriculture is still characterised by the low use of productive farm assets DAFF (2012). In contrast to simple, outdated farming tools, it is assumed that access to modernised farm technologies is likely to increase the scale of farm production, which consequently improves access to more land.

Descriptive statistics indicated that the surveyed households were headed by a married female. Table 5 showed that the gender and marital status of the household head are statistically significant and positively influencing farmer's access to agricultural land. This is consistent with the *a priori* expectations of the study. The study assumed that male-headed households have more exposure and access to agricultural land than female-headed households, which have limited rights to land. According to Mabuza (2009) and Sibanda (2012), men are major holders of land title deeds or allocations, which allows them to effectively engage in productive farming practices. Marital status determines the stability of most families (Gobena, 2012). Musemwa *et al*. (2008) states that married household heads are more stable in agriculture, which has a positive influence on the households' production

and marketing patterns. In most rural areas, married household heads can more easily acquire a piece of land from a traditional leader than single-headed households. This means that married household heads face lower probabilities of limited access to land compared to single household heads.

Education level of the household head will decrease the likelihood of access to agricultural land (Table 5). This is consistent with the *a priori* expectations of the study. According to Marenya & Barrett (2011), education level denotes human capital and the ability of the household head to make better farming decisions. Thus it is assumed that educated farmers can better utilise agricultural production and marketing information, which have a positive influence on the households' production and marketing patterns. The surveyed households had at least five years of formal education, which is low, and constrains their capability to acquire more land. According to Njuki *et al*. (2013), there is still a large number of uneducated smallholder farmers with limited technological skills, financial ability and innovative ideas towards smallholder development. A low level of formal education is a major factor to the limited adoption of improved and productive farming practices in South Africa's smallholder agriculture, which consequently reduces the likelihood of acquiring more land.

3.6 Conclusion

The study found that smallholder farmers faced limited access to agricultural land and farm services in and/or out of the farm, such as farm credit facilities, formal markets, better farm inputs, extension support and proper farm infrastructure. The identified constraints were statistically and significantly influenced by a number of factors such as households' farm activities, cultivated area, field condition, mixed fertilizer, household size and income, farm assets, education level, marital status and gender of the household head. The study concluded that smallholder farmers seek to increase agricultural production in order to improve their livelihoods. Only a better integrated mixed crop-livestock agriculture is more likely to improve agricultural production through better understanding of production constraints related to access to agricultural land and farm services. This will allow farmers to address constraints simultaneously, in order to take an ideal direction for their development through improved farming.

The study recommends that, given the constraints faced by smallholder farmers, strategic measures to increase access to land and farm services should be implemented jointly, so that

farmers will be inclined to improve their farming. The findings revealed that policymakers should implement strategies which take into consideration the production constraints in order to secure meaningful smallholder development in communal areas. These strategies should integrate smallholder livestock-crop production and strengthen the linkages, in order to further improve agricultural production in KwaZulu-Natal province. The policies and strategies should support expansion and further promote effective diversification of farm activities, increased cultivated areas, fenced farming areas and modernised farm assets and reduce outdated farming technologies. Farmers' associations should be well established or restructured, especially in productive farming practices, in order to ensure a central point where farmers can share important farming knowledge and information on new farming opportunities that could reduce their constraints. Farmers should form co-operative societies for ease of access to land, markets, improved farm inputs and extension from financial bodies, government and NGOs. Investment priorities and policies should recognise available agricultural opportunities and production constraints in smallholder agriculture and create an enabling environment to increase farm production. Intensive research should integrate institutions and production policies in a multi-agent based model that generates agricultural policy options in the near future, in order to improve the farm production and the livelihoods of rural households.

CHAPTER 4

FACTORS INFLUENCING FARMERS' CHOICE OF FARMING PRACTICES IN KWAZULU-NATAL

Abstract

South Africa's smallholder farmers are constantly adopting farming practices in order to sustain their livelihoods. However, the currently inefficient and low-yielding farming practices in smallholder agriculture have led to more than half of smallholder farming population being unable to achieve their households' food requirements, especially rural households whose livelihoods are dependent on agriculture. The present study investigated and assessed the factors influencing smallholder farmers' choice of farming practices in KwaZulu-Natal province (KZN). It is an attempt to determine whether or not farm level characteristics can significantly influence farmers' choice of farming practices. Data were drawn from a sample of 400 households in Ndwedwe and Umzimkhulu Local Municipalities (LM) in KZN over one-month period, using a structured questionnaire. Farmers were selected using a multistage randomised sampling method. Descriptive statistics were used to describe households' farm level characteristics, while a multinomial logistic model (MNL) was used to examine and identify the factors influencing smallholder farmers' choice of farming practices.

The common farming practices of choice were subsistence crop farming, improved crop farming and mixed farming. The estimated MNL model revealed that the choice of farming practices is statistically and significantly influenced by household size, total land size, type of agricultural land and access to markets, education level and age of the household head. The study concluded that smallholder farmers seek farming opportunities to improve smallholder agricultural production through innovation and adoption of productive farming practices. It recommends that farm extension and research should be intensified to identify efficient and high-yielding farming practices within the contexts of a sustainable smallholder agricultural approach. This will allow relevant development agents to facilitate, safeguard and reduce the production constraints that hinder smallholder farmers from adopting improved farming practices.

Keywords: Smallholder, households, consumption, agricultural production, farming practices, MNL.

4.1 Introduction

Smallholder farming practices are highly diversified, as they take the form of crop, livestock and mixed farm production (Ellis, 1998). These farming practices are structured to improve the livelihoods of rural households (Garrity *et al.*, 2012). Through proper management of available farm resources, these farming practices are able to meet and achieve the goals of a number of households (Dixon *et al*., 2001). Smallholder farmers are made up of a population with a broad and similar resource base, enterprise patterns, household livelihoods and constraints (Mabuza, 2009). Smallholder farming systems change with changes in local resources, culture, history and other factors (Norton *et al*., 2010). However, the capacity of an individual household to improve farm production depends on its ability to adopt, adapt and manage farming practices, including institutions and available resources from internal and external sources (Enki *et al*., 2001). Pannella *et al.* (2014) stated that the limited access to farm resources has constrained the production choices of resource-poor farmers in most developing counties.

The success or failure of farming practices to improve farm production depends not only on farmers' capability to produce, but also on social, commercial and institutional conditions under which the farmers operate (Mabuza, 2009). Norton *et al*. (2010) stated that the solution to most constraints and limited adoption of high yielding farming practices in smallholder agriculture depends on agricultural development. However, the main challenge to agricultural development, which can be in three main categories, namely subsistence crop farming, mixed crop-livestock subsistence and commercial agriculture, is to stimulate improvements in farm production by identifying well-adapted, efficient and high-yielding farming practices within the contexts of a sustainable smallholder farming approach (Norton *et al*., 2010). Khapayi & Celliers (2016) pointed out that smallholder farmers are not inefficient, even though they are often considered poor because of their limited access to farming resources. These farmers are constantly shifting from subsistence production practices, the main purpose of which is domestic consumption, to improved crop or diversified farming practices, to improve production and livelihoods (Chirwa & Matita, 2012). According to ILRI (1996), when risk and uncertainties are high, a farmer may be reluctant to shift from traditional farming and production patterns that he has known, understood and practised for several years to a new one that promise a higher yield. An understanding of the nature of agriculture in communal areas of developing countries and the steps needed to stimulate it in each specific area is therefore required.

The choice of farming practices and the large number of rural households involved in agricultural production requires special attention to understand their farming perspectives (Mabuza, 2009). This will help narrow the gap between smallholders' choice of farming practices and the required farming strategies to effectively and sustainably support rural livelihoods (Thamaga-Chitja & Morojele, 2014). Thus a clear understanding of factors influencing smallholders' choice of farming practices in developing countries is important to assist in initiating and implementing the required development interventions and policies in smallholder agriculture. This will allow policymakers to make better decisions that ensure the availability and proper allocation of farm resources (Swagata, 2016). The study aimed to identify the specific factors influencing smallholder farmers' choice of farming practices in KwaZulu-Natal.

4.2 Methodology

This section described the research methodology used in eximining the factors influencing farmers' choice of farming practices in KwaZulu-Natal province. The section presents a detailed description of the study area, data collection, sampling technique, model variables and data analytical procedures. The resulting data was utilised for different levels of statistical analysis. Descriptive statistics and the multinomial logistic model is presented in this section.

4.2.1 Study area

The description of the study area for this chapter is the same as that explained in section 3.3.1.

4.2.2 Data collection

The data collection procedure used for this chapter is identical to the one explained in section 3.3.2.

4.2.3 Sampling procedure

The detailed sampling procedure for this chapter is the same as to the one explained in section 3.3.3.

4.2.4 Data analyses

The study adopted descriptive statistics and the MNL model for data analysis. The data was analysed using SPSS, a software package that is used to perform data entry and statistical analysis (Blumenthal, 2010). According to Blumenthal (2010), SPSS is more intuitive and easier to use than other statistical software packages. Descriptive statistics were therefore used to examine the farm level characteristics of sampled households, while the MNL model was used to examine and identify the factors influencing the choice of farming practices in KwaZulu-Natal.

4.2.5 Model specification

The MNL model is an extension of binary logistic regression that allows for more than two choice categories of the dependent variable (Starkweather & Moske, 2011). According to Demeke & Haji (2014), this model differs from binary probit or logit models, which are limited to two choice categories. According to Starkweather & Moske (2011), the MNL model is an effective analytical tool because it does not assume normality, linearity or homoscedasticity. The MNL model was used following Rahji & Fakayode (2009), to express the likelihood of each household being in a particular group. The MNL model was preferred because it permits analysis of decisions across more than two categories in the dependent variable, which made it possible to determine the choice probabilities for several farming practices (Maddala, 1990). The survey households were categorised into three groups based on adopted farming practices, which included subsistence crop farming, improved crop farming and diversified farming. The choice of farming practices were obtained from answers to the survey question on farming practices adopted by each household. The MNL model is expressed as follows:

$$\Pr(y_i = j) = \frac{\exp(X_i\beta_j)}{1+\sum_{j=1}^{J}\exp(X_i\beta_j)}, \text{ for j=1 2, 3} \quad (1)$$

Where y_i is the observed dependent variable, X_i is a vector of farm level characteristics and β_j is the unknown parameters. According to Ojo *et al*. (2013), $\Pr(y_i = j)$ is determined once the probabilities for j=1, 2 and 3 are identified. Thus Eq. 1 was summarised for the study as follows:

$$P_{ij} = \frac{\exp(\gamma_j X_i)}{1+\sum_{j=1}^{3}\exp(\gamma_j X_i)} \quad (2)$$

Where P_{ij} is the likelihood of a household being in either group 1 or 2. According to Greene (1993), Kimhi (1994), Maddala (1990) and Rahji & Fakayode (2009), the coefficients of the reference group are standardised to zero because the probabilities for all the choices must add up to unity. Thus, for three choices, only two distinct sets of parameters can be identified and estimated.

Thus Eq. 2 becomes:

$$P_{i0} = \frac{1}{1+\sum_{j=1}^{3} \exp(\gamma_j X_i)} \text{, for j= 0} \quad \text{(3)}$$

Where P_{i0} is the likelihood of being in the reference category or group 0. According to Ojo *et al*. (2013), the natural logarithms of the odd ratio of Eq. 1 give the estimating equation as follows:

$$\ln = \frac{P_{ij}}{P_{i0}^{\gamma_j X_i}} \quad \text{(4)}$$

Equation 4 indicates the relative probability of either group 1 or 2 to the probability of the reference group (Ojo *et al*., 2013). The estimated coefficients for each group reflect the influence of X_i's on the likelihood of the individual household choosing that alternative relative to the reference group. Hill (1983), Ojo *et al.* (2013) and Rahji & Fakayode (2009) stated that the coefficients of the reference group may be recovered by using the following formula:

$$\gamma_3 = -(\gamma_1 + \gamma_2) \quad \text{(5)}$$

For each farm-level characteristic, the negative of the sum of its parameters for groups 1 and 2 is normally the parameter for the reference group (Ojo *et al*., 2013). The estimated MNL model included all the farm-level characteristics listed in Table 6 to analyse the factors influencing the choice of farming practices adopted by the surveyed households in KwaZulu-Natal province.

4.2.6 Explanatory variables used in the MNL model and their *a priori* expectations

The key explanatory variables considered for the multinomial logistic model are presented in Table 6.

Table 6: Description of key variables included in the MNL model

Name of variable	Description of the variables	Expected sign
Household income	Gross monthly household income from farm production, remittances, pension, etc. (*continuous*)	+
Market access	Access to produce markets (*dummy*): 1 if the household head participated in the market, 0 otherwise	-
Age	Age of the household head in years (*continuous*)	-
Off-farm income	Access to off-farm income (*dummy*): 1 if the household head had access to off-farm income, 0 otherwise	-
Total land size	Individual households' total land size in hectares (*continuous*)	+
Education level	Formal education of the household head in years (*continuous*)	+
Farm credit	Access to credit (*dummy*): 1 if the household had access to farm credit, 0 otherwise	-
Cultivated area	Individual households' cultivated area in hectares (*continuous*)	+
Farm assets	Access to assets (d*ummy*): 1 if the household head had access to farm assets, 0 otherwise	+
Farm extension	Access to farm extension (*dummy*): 1 if the household had access to farm extension services, 0 otherwise	-
Type of land	Type of cultivated land for crop production (*categorical*): 1= homestead garden, 2= dry land, 3= irrigated land	+
Household size	Total number of active household members over the age of 12 years (*continuous*)	+
Farming practices	**Choice set of farming practices adopted by sampled households (*categorical*):** **1= Subsistence crop farming, 2= Improved crop farming, 3= Diversified farming**	

Farming practices: This is a categorical dependent variable. It represent the three-choice set of common farming practices adopted by smallholder farmers in sampled rural households of KwaZulu-Natal province. According to Dixon et al. (2005), Ellis (1998), Mabuza (2009) and

Ngemntu (2009), the most common choice of farming practices cited in the literature includes subsistence crop farming practices, mixed crop-livestock farming and commercial farming practices.

i) **Age:** This is a continuous variable. It is the number of years of the household head's age. The present study assumed that young farmers have better labour productivity and economic potential than old farmers, because they are more open to modern agricultural practices than older farmers, who are still resistant to change. Young farmers are able to modernise farm holdings, because they are more likely to have received farm training which allows them to actively adopt productive farming practices (Baloyi, 2010). It was further assumed that farmers tend to acquire important agricultural knowledge and experience, over time, through continuous learning, which helps them to actively adopt improved farming practices. The age of the household head is therefore expected to negatively influence the choice to adopt subsistence crop farming relative diversified farming practices.

ii) **Education level:** This is a continuous variable. It is the number of years of formal education of the household head. Education level relates to the ability of the household head to make a better farming decisions (Marenya & Barrett, 2011). The study assumed that educated household heads are more likely to utilise agricultural and marketing information, which improves the likelihood to adopt better farming practices. But, there is still a large number of uneducated smallholder farmers, with limited farm technological skills, financial ability and farm innovation to adopt productive farming practices (Njuki *et al*., 2013). The education level of the household head is expected to positively influence the choice to adopt subsistence farming, relative to diversified farming practices.

iii) **Household income:** This is a continuous variable which represents the sum of income received by the household per month directly from farming and other household's income sources. Rural households derives a small proportion of income from farming because of production constraints in smallholder agriculture (Baiphethi & Jacobs, 2009). The study assumed that smallholders have low household income and limited access to farm credit has made it challenging to adopt improved farming practices. This variable is expected to positively influence the choice to adopt subsistence farming relative to diversified farming.

iv) **Farm credit:** This is a dummy variable, taking a value of 1 if the household head has access to farm credit and 0 if not. The majority of smallholder farmers have limited access to farm credit, because they are avoided or turned down by commercial banks, formal micro-credit institutions and national development banks, due to their lack of collateral (Pienaar, 2003 and Sikwela, 2013). Limited access to credit has a negative influence on a farmer's capability to respond to agricultural production opportunities (Jayne *et al*., 1999). However, according to Sindi (2008), access to farm credit overcomes credit constraints. This creates an incentive to improve agricultural production. The present study assumed that access to affordable farm credit is more likely to increase farmers' investments in modern farming technologies for better adoption of productive farming practices. Access to farm credit is thus expected to negatively influence the choice to adopt subsistence farming, relative to diversified farming practices.

v) **Household size:** This is a continuous variable, referring to the number of active household members over the age of 12 years. Smallholder farming is labour intensive and requires a large labour supply (Gobena, 2012). Active household members are the main source of labour, because rural households have limited capability to hire labour (Sikwela, 2013). The study assumed that an increase in the number of active household members will increase the household's labour supply. Household size is expected to negatively influence the choice to adopt subsistence farming relative to diversified farming practices.

vi) **Farm assets:** This is a dummy variable, taking a value of 1 if the household head has access to farm assets and 0 if not. The majority of smallholder farmers have limited access to productive farm assets (Pote, 2008). The households with access to effective farm assets are more likely to adopt improved farming practices. The study assumed that smallholders have access to outdated farm assets only, which reduces the capability of the household to adopt productive farming practices. This variable is therefore expected to positively influence a farmer's choice to adopt subsistence farming relative to diversified farming.

vii) **Type of land:** This is a categorical variable representing the type of cultivated area for crop production. The type of land for crop production is the most influential factor to farmers' choice of farming practices (ECA, 2004). The study assumed that the type of

available land is the key to having control over major farming decisions such as type of crop to produce, farming techniques and practices to adopt. However, there are still few individual rural households with access to arable and/or irrigated land that can be productively used for farming. Most rural households individually cultivate homestead gardens or non-irrigated communal land (Koo, 2014). The type of land is expected to positively influence the choice to adopt subsistence farming relative to diversified farming practices.

viii) **Cultivated area:** This is a continuous variable. It represents the cultivated area of land for crop production activities during the 2014/15 season, in hectares. According to DAFF (2012), smallholder farmers cultivate one or fewer hectares of land per production season. The study assumed that an increase in cultivated area is more likely to increase agricultural production with improved crop farming practices. According to Baiphethi & Jacobs (2009), the cultivated area of smallholder farmers is limited by factors such as access to effective farming inputs and quality of agricultural land in the absence of advanced farming technologies, e.g. seeds and fertilizers. This variable is expected to positively influence the choice to adopt subsistence farming relative to diversified farming practices.

ix) **Total land size:** This is a continuous variable. It represents the total size of arable land in hectares. According to Baloyi (2010), land is a main farm asset and most of the decisions made by farming households are highly influenced by total land size. The study assumed that an increase in total land size will positively influence farmers' decisions to adopt improved farming practices and to increase the scale of agricultural production. However, the majority of smallholder farmers have two or fewer hectares of land where they produce at least 10% of marketable output through subsistence-based production systems (DAFF, 2012). The total land size is expected to positively influence smallholders' choice to adopt subsistence farming relative to improved or diversified farming practices.

x) **Off-farm income:** This is a dummy variable, taking a value of 1 if the household head has access to off-farm income and 0 if not. It is becoming a challenge for most rural households to derive their household income directly from farming because of smallholder production constraints (Dunn, 2014). According to Jayne *et al*. (1999), the majority of smallholders have limited access to off-farm income and farm credit. This

has reduced their capability to adopt improved farming practices. The study assumed that access to off-farm income will generate additional income to complement low household income, which will increase the odds to adopt improved farming practices. This variable is expected to negatively influence the choice to adopt subsistence farming relative to diversified farming.

xi) **Farm extension:** This is a dummy variable, taking a value of 1 if the household head has access to farm extension support and 0 if not. According to Van Averbeke & Mohamed (2006), farm extension is an idea that was introduced under the FSP as an initiative directed at developing smallholders by transferring farming skills to improve farm production and reduce poverty. According to Bembridge (1984), extension support is an important tool in distributing skills and farming technologies to smallholders. The present study assumed that an increase in farm extension will increase the likelihood to adopt productive farming practices. Thus, even though farm extension has been disintegrated and ineffective in smallholder agriculture, it remains important in improving farm production through its capability to address most of the constraints (Karugia *et al*., 2009). More effort to extension could have a positive effect on smallholder agriculture (Pote, 2008). This variable is expected to negatively influence the choice to adopt subsistence crop farming relative to improved crop or diversified farming practices.

xii) **Market access:** This is a dummy variable, taking a value of 1 if the household had access to produce markets and 0 if not. Smallholder farmers primarily produce for household consumption, and those that can sell a surplus are often constrained by limited access to produce markets, especially for livestock (Barrett, 2008). According to Pienaar (2003), a number of smallholder farmers do not even attempt to participate in produce markets, even after producing a marketable surplus. According to Makhura (2001), most smallholders do not participate in produce markets because of usually small marketable surpluses, which often do not adhere to required quantity and quality standards or most markets. The study assumed that an increase in market access will increase the likelihood of adopting productive farming practices in order to maximise agricultural production and meet market demands. This variable is therefore expected to negatively influence the choice to adopt subsistence farming practices relative to improved crop or diversified farming practices.

4.3 Empirical results of the study

This section presents the results of the study in terms of frequencies and percentages through descriptive statistics, statistical and specification tests and empirical results of the MNL analysis.

4.3.1 Descriptive statistics of farm level socio-economic characteristics

Table 7 presents descriptive statistics of farm-level socio-economic characteristics of sampled households.

Table 7: Descriptive statistics of selected farm-level socio-economic characteristics

Independent variables	**Mean**			
	Subsistence crop farming	**Improved crop farming**	**Mixed farming**	**Overall**
	n= 106	**n= 142**	**n= 152**	**n= 400**
Type of land (homestead garden)	0.62	0.52	0.58	0.57
Education level (years)	4.70	5.60	5.18	5.16
Age (years)	56.34	58.12	59.84	58.34
Access to farm extension (% yes)	0.85	0.94	0.82	0.87
Household size (number)	5.58	5.25	5.95	5.60
Household income (R/month)	2368.91	2276.68	2326.30	2393.38
Cultivated area (ha)	1.29	1.09	0.83	1.05
Market access (% yes)	0.24	0.35	0.19	0.22
Access to farm credit (% yes)	0.11	0.14	0.14	0.13
Access to farm assets (% yes)	0.92	0.92	0.94	0.93
Total land size (ha)	1.57	2.02	2.48	1.97
Access to off-farm income (% yes)	0.40	0.35	0.31	0.35

Descriptive statistics depict average values of farm-level characteristics as a basis for understanding the population under analysis. Thus a comparative analysis of the mean and proportion of farm-level characteristics between adopters of subsistence farming, improved

farming and diversified farming practices indicated significant mean differences between descriptive variables.

4.3.1.1 Smallholder farmers' goals and aspirations

Rural households have individual goals and aspirations which are considered driving forces that positively influence their participation in farming practices (Mabuza, 2009). Table 8 gives an indication of farmers' goals for participating in crop and/or livestock farming activities.

Table 8: Smallholder farmers' goals and aspirations

Farmers' goals in crop-livestock production	**Percentage (n=400)**
Household consumption	77.0
Marketing	6.3
Leisure pursuit	6.3
Cultural purposes	0.5
Home consumption and marketing	10.0

Source: Survey (2015)

4.3.2 Factors influencing farmers' choice of farming practices

This section presents the results of statistical and specification tests and those of the MNL analysis.

4.3.2.1 Statistical and specification tests

The assumed farm level characteristics were checked for signs of statistical problems such as multicollinearity using the Variance Inflating Factor (VIF) prior to final MNL analysis or the final model regressions. According to Haitovsky (1969), it is always important to check for the existence of statistical problems among independent variables prior to final regression analysis. Statistical problems such as multicollinearity arise from a linear relationship between independent variables, which can cause the estimated regression coefficients to have the wrong signs, high R-square values and smaller t-ratios for a number of variables in the regression (Tesfay, 2014). Multicollinearity can also result in large variance and standard errors, with varied confidence intervals which often make it difficult to estimate the exact effect of independent variables on the dependent variable (Woodridge, 2001). Table 9

presents the results of statistical and specification tests or collinearity statistics prior final MNL analysis.

Table 9: Statistical and specification tests

Name of variable	**VIF**
Household income	1.097
Cultivated area	1.464
Total land size	1.822
Household size	1.026
Age	1.173
Market access	1.327
Type of land	1.069
Education level	1.146
Farm assets	1.027
Farm extension	1.072
Farm credit	1.042
Off-farm income	1.100

Table 9 shows that there were no serious multicollinearity problems among selected farm-level characteristics. The VIF of 10 or greater normally indicates that there might exist multicollinearity among independent variables (Haitovsky, 1969). Since there was no serious correlation between descriptive variables, all the variables were included in the final MNL analysis.

4.3.2.2 Results of the MNL analysis of factors influencing farmers' choice of farming practices

In order to identify the specific factors influencing smallholders' choice of farming practices in sampled rural households, the three choice categories representing the common farming practices were regressed on selected farm-level characteristics presented Table 6. The maximum likelihood estimates of the multinomial regression analysis for choice of subsistence and improved crop farming, relative to diversified farming practices are presented in Table 10.

Table 10: MNL estimates of determinants of farming practices (N=400)

Independent variables	Subsistence crop-farming practices				Improved crop-farming practices			
	β	P-values	Sig.	Odds ratios	β	P-values	Sig.	Odds ratios
Type of land (homestead garden)	1.579	0.020	**	4.730	0.428	0.427	ns	1.534
Education level (years)	-0.087	0.050	ns	0.917	-0.080	0.042	**	0.923
Age (years)	-0.037	0.009	***	0.963	-0.027	0.035	**	0.974
Access to farm extension (% yes)	-0.879	0.114	ns	0.425	-0.198	0.530	ns	0.820
Household size (number)	-0.206	0.011	**	0.814	-0.115	0.113	ns	0.892
Household income (R/month)	0.000	0.449	ns	1.000	0.000	0.133	ns	1.000
Cultivated area (ha)	0.280	0.343	ns	1.323	0.343	0.239	ns	1.409
Market access (% yes)	-1.741	0.000	***	0.175	-1.312	0.005	***	0.269
Access to farm credit (% yes)	0.404	0.411	ns	1.498	0.420	0.363	ns	1.523
Access to farm assets (% yes)	-0.819	0.271	ns	0.441	0.344	0.554	ns	1.411
Total land size (ha)	0.907	0.000	***	2.477	0.467	0.028	**	1.596
Access to off-farm income (% yes)	-0.176	0.616	ns	0.839	0.104	0.726	ns	1.110
Intercept	0.737	0.647			-0.426	0.767		

Reference category: **Diversified farming practices**; Prob > Chi^2: 0.000; Pseudo- R^2 value of 0.474; McFadden R^2: 0.242; ***: significant at 1% level, **: significant at 5% level; ns: not significant

The influence of the estimated coefficients for each choice category was made with reference to diversified farming practices (reference category). The Prob > Chi^2 (0.000) indicates that the estimated MNL model had a strong explanatory power (Hill, 1983). Thus the selected farm-level characteristics were collectively significant in explaining farmers' choice of farming practices.

The results of the estimated MNL model were interpreted in terms of significance and signs of the parameters. Thus a set of farm level characteristics differed across the categories in terms of significance levels and signs on the parameters. The results of the MNL model indicated that six farm level characteristics are statistically and significantly influencing smallholder farmers' choice of farming practices. Thus total land size and type of available land are statistically significant and positively influencing adoption of subsistence and improved crop farming practices relative to diversified farming, while household size, market access, age and education level of the household head are statistically significant and negatively influencing adoption of subsistence and improved crop farming relative to diversified farming.

4.4 Discussions

This section presents discussions of results obtained through descriptive statistics and a MNL analysis.

4.4.1 Households' farm level socio-economic characteristics

On average, the survey households were headed by a 58-year-old with at least five years of formal education (Table 7). Smallholder agriculture is still considered a non-economic activity for uneducated older people (Sihlobo, 2015). The study assumed that young farmers are better educated and are open to modern farming practices than older farmers who are resistant to change. Thus young farmers are farm innovative and less risk averse, with the capability to make better choices when adopting specific farming practices, compared to older farmers (Baloyi, 2010). However, even though an average of five years of formal education characterise a less educated farmer, an average of 58 years also implies that the household head is more likely to have enough practical farm experience to adopt productive farming practices, because farmers tend to acquire agricultural knowledge and experience over time through continuous learning, which helps them to actively adopt improved farming practices.

The surveyed households had six active household members. This presented a form of active household labour to complement the efforts of the household head in various agricultural activities (HLPE, 2013). Rural households often rely on active household members for labour, because they do not afford to hire labour (Sikwela, 2013). The present study assumed that an increase in total number of active household members would increase the household's labour supply for various farming activities. An average household size of six active members implies a sufficiently large labour force, which could positively influence the odds of choosing to adopt diversified farming practices, in order to fully utilise the available labour across different farming activities for optimum farm production. Table 7 showed that the surveyed households cultivated one hectare of homestead gardens from a total land size of two hectares. Smallholder farmers own and/or cultivate less than two hectares of land (DAFF, 2012). The study assumed that the type of cultivated land is the key to having control over the type of crop to produce and farming techniques and/or practices to adopt. Land holding size has a positive effect on farmers' decisions regarding what to produce and the level of output to expect (Baloyi, 2010). An increase in land holding size by a hectare and the type of cultivated area implies that farmers could actually increase the scale of crop production, through improved crop farming practices, in order to maximise farm production per hectare.

The results in Table 7 shows that the surveyed households had access to farm extension and assets, but limited access to farm credit and markets during the 2014/15 season. Even though smallholders have access to farm extension, it is not effective enough to assist them in adopting productive farming practices. According to Pote (2008), the effectiveness of the extension services have declined throughout the 1990s, due to inappropriateness of farm training and extension models pursued, delayed adoption of alternative models and sharp reduction in the operational budgets of the sector ministries. The present study assumed that households with access to effective farm assets are more likely to adopt better farming practices. However, smallholder farmers have access to outdated farm assets only, which reduces their capability to adopt productive farming practices. The cultivated area is thus limited by factors such as farming tools (Mabuza, 2009). Limited access to credit and markets are among the constraints facing smallholder farmers (Sikwela, 2013). Limited access to credit is the main reason smallholder farmers still cannot afford to adopt productive farming practices, which have a potential to improve farm production in order to create ease of access to markets.

The surveyed households had limited access to off-farm income and an average household income of R2393.38 per month (Table 7). The income is low and less likely to influence the choice of adopting productive farming practices for optimum farm production. The present study assumed that access to off-farm income from crafting, sewing, brick-laying and other off-farm income sources will generate additional income, which will probably increase the likelihood to adopt productive farming practices. However, limited access to off-farm income implies that the household head had low income to complement their household income. The surveyed households did not have a high working capital to invest in productive farming practices.

4.4.1.1 Smallholder farmers' goals and aspirations

Table 7 showed that the majority of surveyed households participated in farming activities for household consumption purposes. Six percent of the surveyed households claimed to have produced for either marketing purposes or just leisure pursuit, while 10% of the households produced for household consumption and/or marketing. Only 0.5% of farmers produced for cultural purposes (Table 8). According to Baloyi (2010), even though there is a great difference between crop and livestock activities among smallholder farmers in communal areas in terms, of labour demand and household uses, the majority of households do not engage in livestock production for marketing purposes, except to meet consumption and cultural goals. Smallholder farmers have very limited market access for livestock output (Barrett, 2008).

4.4.2 Factors influencing farmers' choice of farming practices

The total land size was statistically significant and positively influenced the likelihood of adopting subsistence and improved crop farming. This implies that, total land size will increase with an increase in adoption of subsistence crop farming and improved crop farming practices, relative to diversified farming practices. This is consistent with the *a priori* expectations of the study. The surveyed households had a total land size of two hectares and according to DAFF (2012), the majority of smallholder farmers have two or less hectares of land where they produce at least 10% of marketable farm produce through subsistence-based production systems. The present study assumed that an increase in total land size would mean that the majority of households have enough land to diversify farm activities, which is a food security strategy and a practical approach to spread risk by ensuring that there is always a farm activity to sustain livelihoods in case one fails (Sikwela, 2013). However, an average

total land size of two hectares is small and it is likely to reduce the likelihood of adopting diversified farming practices, which require several farm inputs and enough land for various farming activities.

The MNL model indicated that access to produce markets and age of the household head was statistically significant and negatively influenced the likelihood of adopting subsistence and improved crop farming. This implies that market access and age of the household head reduced the likelihood of adopting subsistence and improved crop farming relative to diversified farming practices. The surveyed households were headed by a 58-year-old with limited access to produce markets. The study assumed that young farmers are more open to modern farming technologies which allow them to adopt improved and productive farming practices. However, older farmers can also adopt productive farming practices, because farmers acquire agricultural knowledge and experience over time through continuous learning (Baloyi, 2010). The present study assumed that an increase in market access will increase the likelihood of adopting productive farming practices in order to meet market demands. Smallholders fail to access markets because of small marketable surplus which does not attract markets or adhere to required quantity and quality standards (Makhura, 2001). Limited access to markets could actually inspire households to consider adopting diversified farming practices in order to ensure household food security. This could also enable them to meet market demands.

Education level of the household head was statistically significant and negatively influencing the likelihood of adopting improved crop farming. This implies that the education level of the household head reduced the likelihood of adopting improved crop farming relative to diversified farming. The present study expected the education level of the household head to increase the probability of adopting subsistence crop farming, relative to improved or diversified farming, because the majority of smallholders are uneducated, which implies a limit to technical skills, financial ability and farm innovation for effective adoption of improved farming practices. Education level relates to the ability of the household head to adopt better farming practices (Marenya & Barrett, 2011). The surveyed household heads had an average of five years of formal education, which does not present a strong capability to adopt improved crop or diversified farming practices, which require improved farm inputs and innovative farming technologies to diversify crop-livestock farm activities for optimal farm production.

The MNL model indicated that the type of cultivated area was statistically significant and positively influenced the likelihood of adopting subsistence crop farming. This suggests that the type of cultivated area increased the likelihood of adopting subsistence crop farming relative to diversified farming practices. This is consistent with the *a priori* expectations of the study. The surveyed households individually cultivated homestead gardens. The present study assumed that the type of cultivated land is key to having control over the type of crop to produce, farming techniques and practices to adopt (ECA, 2004). The majority of rural households individually cultivate homestead gardens for crop production, instead of distant irrigated or dry land, which is communally owned (Andrew *et al*., 2003). Irrigated lands almost do not exist in communal areas because of poor farm infrastructure in smallholder agriculture. It was thus assumed that homestead gardens are too small and can only be used to produce enough food for the household's consumption purposes through subsistence-based farming practices.

Results presented in Table 10 revealed that the household size reduced the likelihood of adopting subsistence crop farming relative to diversified farming. This is consistent with *a priori* expectations of this study. It was assumed that an increase in the total number of active household members will increase the probability of adopting diversified farming practices. The surveyed households had an average of six active members to complement the efforts of the household head (HLPE, 2013). According to Gobena (2012), smallholder agriculture requires a large labour supply in order to maximise farm production. The average household size of six active members is thus most likely to meet the household's labour requirements, which will positively influence the probability of adopting diversified crop-livestock farming practices in order to fully utilise the available, active household labour across a number of farming activities.

4.5 Conclusion and recommendations

The common farming practices of choice were subsistence crop farming, improved crop farming and diversified farming practices. The surveyed households had individual goals and aspirations, which were considered driving forces that significantly influenced farming practices. The majority of surveyed households participated in farming activities for household consumption purposes. The estimated MNL model revealed that smallholders' choice of farming practices were statistically and significantly influenced by the total land size, type of land, market access, household size, education level and age of the household

head. The study concluded that smallholders seek farming opportunities that will create an enabling environment to improve agricultural production through the adoption of productive farming practices.

The study recommends that farm extension support and research should be intensified to identify well-adopted, efficient and high-yielding farming practices within the contexts of a sustainable smallholder farming systems approach. This will allow development agents to facilitate, safeguard and reduce the constraints that hinder farmers from adopting productive farming practices in order to be able to take preferred direction in their development. The present study also recommends that farming opportunities should be explored to encourage smallholder farmers to diversify farming activities. Investment priorities and policies should recognise the immense diversity of opportunities and production constraints facing farming rural households in communal areas and empower them to create an enabling environment where they would be able to engage in productive farming. The government, NGOs and other stakeholders should continue to invest funds in smallholder agriculture in order to improve limited access to farm credit, which is thought to hinder farmers from adopting improved farming practices.

CHAPTER 5

SUMMARY, CONCLUSION AND STUDY RECOMMENDATIONS

5.1 Summary of the study

The specific objectives of the study were to identify and examine the production constraints faced by smallholders and their effects on agricultural production and also to identify and assess the main factors influencing their choice of farming practices in KwaZulu-Natal province. The study was undertaken in Umzimkhulu and Ndwedwe local municipalities in KwaZulu-Natal province of South Africa. A sample size of 400 rural households were randomly selected using a multi-stage randomised sampling technique. The interviews were conducted using a structured questionnaire. The study also intended to investigate smallholders' resource levels and other farm level characteristics and their effects on farm production.

The surveyed households participated in crop and/or livestock farming activities for household consumption. These rural households derived most of their livelihood from other household income sources, such as remittances, government social support grants, in order to complement their low household income though other sources on income other than agriculture. Thus the prevailing production constraints in smallholder agriculture has made it a challenge to derive adequate farm income. The study identified three principal components of production constraints and examined them to determine their effects on smallholder agricultural production. These constraints were limited access to agricultural land and farm services such as produce markets, farm extension services and poor farm infrastructure and farm inputs.

Three choice categories of farming practices were also identified and examined which included subsistence crop farming practices, improved crop farming and diversified farming practices. The specific factors that statistically and significantly influenced the identified constraints were field condition, cultivated area, education level, farm assets, type of farming activities, marital status and gender of the household head, while the specific factors that statistically and significantly influenced farmers' choice of farming practices were total land size, type of cultivated area, household size, age, education level of the household head and market access.

5.2 Conclusion

The surveyed households faced limited access to agricultural land and farm services. The common farming practices of choice were subsistence crop farming, improved crop farming and diversified farming. The study concluded that, even though smallholder farmers can effectively adjust livelihood strategies to production constraints, they constantly seek farming opportunities that will create an enabling environment to reduce the production constraints they are facing in order to improve their adoption choice of farming practices and increase production.

5.3 Study recommendations

Moving from subsistence-based production systems to more specialised agriculture requires increased capital and investment flows that focus on farmers and their specific production constraints. Thus the study recommends ease of access to agricultural land and farm services in smallholder agriculture in order to mitigate the production constraints faced by smallholder farmers in communal areas. The significant factors influencing the production constraints in smallholder agriculture need to be addressed simultaneously in order to allow smallholder farmers to take preferred path in their development. That is, access to agricultural land and farm services should be implemented jointly so that farmers could be inclined to improve their farming practices. It is also important that development agents prioritise farm infrastructure, especially fencing of farming areas, availability of improved farm inputs and assets, e.g. machinery and equipment when addressing production constraints in smallholder agriculture.

Smallholder agriculture mostly consist of old, female farmers with low education levels, poor farm infrastructure and limited farm assets. These factors have significant influence on the production constraints in smallholder agriculture. Thus, farm services such as extension support, research facilities and produce markets should be made readily available for smallholder farmers. Farm extension and research can be used to educate smallholders about agricultural production and market patterns. This could allow them to understand the constraints as a first step towards addressing them. This can also be achieved through establishment of effective farmers' associations to ensure a central point where smallholders can share important information on farming opportunities that could address their production constraints.

Farming opportunities should be explored to encourage smallholder farmers to diversify their farming activities. Thus farm extension could educate smallholders about diversification of farming activities and make them aware of their land sizes, types of land they are using for crop production, market requirements and how to effectively allocate available agricultural resources, e.g. household labour for various farming practices, because these are the factors influencing their choice of farming practices. This could also channel towards effective adoption of improved and high-yielding farming practices for sustainable smallholder agriculture. Thus there is a need for technical skills in terms of production and marketing patterns, effective resource use, farm support and innovation in order to adopt improved farming practices.

References

Aina, L. O. (2007). Globalisation and small-scale farming in Africa: What is the role for information centres? World libraries and information congress. 73rd IFLA General Conference and Council. Durban, South Africa.

Alemu, Z. G. (2012). Livelihood strategies in rural South Africa: Implications for poverty reduction. Selected paper prepared for presentation at the International Association of Agricultural Economics (IAAC) Triennial Conference, Foz do Iguacu, Brazil.

Aliber, M. and Hall, R. (2012). Support for smallholder farmers in South Africa: Challenges of scale and strategy: *Institute for Poverty, Land and Agrarian Studies (PLASS), 29* (4), 435- 553.

Amemiya, T. (1985). Business & Economics. *Harvard University Press*. Cambridge, United States of America.

Andrew, M., Ainslie, A. and Shackleton, C. (2003). Land use and livelihoods: Evaluating local and agrarian reform in South Africa. *An Occasional Paper Series*. PLAAS, University of the Western Cape.

Awoke, M. U. and Okorji, C. (2004). The determination and analysis of constraints in resource use efficiency in multiple cropping systems by smallholder farmers in Ebonyi State, Nigeria. *Africa Development, 56* (3), 58- 69.

Ayuya, O. I., Kenneth, W. S. and Eric, G. O. (2012). Multinomial logit analysis of small-scale farmers' choice of Organic Soil Management Practices in Bungoma County, Kenya. *Journal of Social Sciences 4* (4), 314- 322.

Babatunde, R. O. and Leliveld, A. (2012). *On-farm and off-farm works: complements or substitutes? Evidence from Rural Nigeria*. Department of Agricultural Economics and Farm Management, University of Ilorin, Nigeria.

Bacou, M. (2014). *Farm characteristics*. [Online]. Retried from: https://harvestchoice.org. Accessed on 16 January.

Baiphethi, M. N. and Jacobs, P. T. (2009). The contribution of subsistence to food security in South Africa. *Agrekon, 46* (4), 459.

Baiyegunhi, L. J. S. and Fraser, G. C. G. (2014). Poverty incidence among smallholder farmers in the Amathole District Municipality, Eastern Cape Province, South Africa. *Journal of Human Ecolology, 46* (3), 621- 273.

Baloyi, J. K. (2010). *An analysis of constraints facing smallholder famers in the Agribusiness value chain: A case study of farmers in the Limpopo Province* (masters thesis, University of Pretoria).

Barrett, C. B. (2008). Smallholder market participation: Concepts and evidence from Eastern and Southern Africa. *Food Policy 33* (4), 299- 317.

Battaglia, M. P. (2008). *Multi-Stage Sample: Research methods*. [Online]. Retrieved from: https://srmo.sagepub.com. Access on 15 October.

Baum. C. F. (2013). Limited Dependent Variables. Birmingham Business School. Boston College and DIW Berlin, pp. 2.

Bediako, E., Showemimo, J.N. and Ushawu, Y. (2007). Production constraints in tomato production at Bontanga irrigation project in the Northern Region of Ghana. *Applied Sciences Journal, 7* (3), 451- 471.

Bembridge, T. J. (1984). *A systems approach: The study of agricultural development problems in Transkei* (doctoral thesis, University of Stellenbosch).

Bienabe, E., Coronel C., Le Coq, J. and Liagre, L. (2004). Linking smallholder farmers to markets: Lessons learned from literature review and analytical review of selected projects. *Study Report*. CIRAD & IRAM. World Bank.

Blumenthal, E. (2010). Introduction to SPSS. Centre for Social Science Computation and Research, University of Washington, USA.

Bosch, D., Budlender, D. and Tshabalala, S. (2002). Towards a National Child Labour Action Programme for South Africa. *Discussion Document*. Department of Labour, Pretoria, SA.

Chamberlin, J. (2008). It's a Small World After All: Defining Smallholder Agriculture in Ghana (Published paper). *International Food Policy Research Institute*. Africa, Ethiopia.

Chirwa, E. W. and Matita, M. (2012). From subsistence to smallholder commercial farming in Malawi: A case of NASFAM commercialisation initiatives. *Working Paper, 37*. Future Agricultures Consortium.

Chu, Y., Yu, J. and Huangl, Y. (2010). Measuring Airport Production Efficiency Based on Two-stage Correlative DEA. Paper presented during Industrial Engineering and Engineering Management (IE&EM). IEEE 17th International Conference.

Clifton, R. and Wharton, J. R. (1969). Subsistence agriculture and economic development: Concepts and scope. Frank Cass and Co. LTD, USA.

Cousins, B. (2012). Smallholder irrigation schemes, agrarian reform and 'accumulation from below: Evidence from Tugela Ferry, KwaZulu-Natal. Proceedings of the 2012 Conference of "Strategies to overcome poverty and inequality" held at the University of Cape Town, Cape Town, South Africa.

DAFF. (2011). *South African Agricultural Production Strategy. Department of Agriculture, Forestry and Fisheries*. [Online]. Retrieved from: https://www.daff.gov.za. Accessed on 04 Sept. 2015.

DAFF. (2012). *A framework for the development of smallholder farmers through cooperatives development*. [Online]. Retrieved from: https://www.daff.gov.za. Accessed on 15 September.

Daniel, E. (2013). Assessment of agricultural extension services in Tanzania: A case study of Kyela, Songea rural and Morogoro rural districts. *Internship report in Plant Sciences*. CSA.

Darroch, M. A. G. and Mushayanyama, T. (2006). Smallholder farmers' perceptions of factors that constrain the competitiveness of a formal organic crop supply chain in KwaZulu-Natal province, South Africa. *SAJEMS NS, 9* (4), 498- 513.

DBSA. (1986). Policy guidelines in respect of farmer support programmes. Development Planning Division. Halfway House, SA.

Delgado, C. L. (1997). The role of smallholder income generation from agriculture in Sub-Saharan Africa. *Achieving Food Security in Southern Africa: New challenges and opportunities*. International Food Policy Research Institute. Washington, D.C.

Demeke, L. B., & Haji, J. (2014). Econometric analysis of factors affecting market participation of smallholder farming in Central Ethiopia. *Journal of Agricultural Economics, Extension and Rural Development, 2* (6), 86- 102.

Dent, R. J. (1989). *Sustainable agriculture for small-scale farmers: A farming system perspective*. Faculty of Agriculture, Kasetsart University, Bangkok, Thailand.

Dixon, J., Gulliver, A. & Gibbon, D. (2001). Farming Systems and Poverty: *Improving Farmers' Livelihoods in a Changing World*. Food and Agriculture Organisation and World Bank, Rome, Italy.

Dixon, J., Tanyri, A. & Watternbach, H. (2005). *Framework for analysing impacts of globalization on smallholders. Agriculture and Consumer Protection*. [Online]. Retrieved from: https://www.fao.org. Accessed on 15 January.

Dorosh, P. and Haggblade, S. (2003). Growth linkages, price effects and income distribution in sub-Saharan Africa. *Journal of African Economics, 12* (2), 207- 232.

Duflo, E., Kremer, M. & Robinson, J. (2011). Sustainable Agricultural Productivity for Food, Income and Employment. *Africa Human Development Report*. Kenya.

Dunn, E. (2014). Smallholders and inclusive growth in agricultural value chains. *United Stated Agency for International Development (USAID), Volume 18*. United States Government.

ECA (Economic Commission for Africa). (2004). Land tenure systems and their impact on food security and sustainable development in Africa. *Research Paper*. Addis Ababa, Ethiopia.

Ellis, F. (1999). Peasant Economics: *Farm Households and Agrarian Development*. Cambridge University Press, Cambridge.

Ellis, F. (1998). Household strategies and rural livelihood diversification. *The Journal of Development Studies, 35* (1), 1- 38.

Enete, A. A. & Igbokwe, E. M. (2009). Cassava market participation decision of producing households in Africa. *Tropicultura, 27* (3), 130.

Enki, M., Belay, K. & Dadi, L., (2001). Determinants of adoption of physical soil conservation measures in central highlands of Ethiopia: The case of three districts of Shewa. *Agrekon, 40* (3), 293- 315.

FAO. (2000). *Farming systems and poverty: Improving farmers' livelihoods in a changing world*. [Online]. Retrieved from: https://www.fao.org. Accessed on 14 September.

FAO. (2001). The state of food and agriculture: Rural non-farm income in developing countries. *FAO Agriculture series, 31*. Rome, Italy.

FAO. (2014). Understanding smallholder farmer attitudes to commercialization: The case of maize in Kenya. Rome.

Fan, S. and Chan-Kang, C. (2003). Is small beautiful? Farm size, productivity and poverty in Asian agriculture. Plenary paper prepared for the 25th International Conference of Agricultural Economists. Durban, South Africa.

Feder, G. and Noronha, R. (1987) Land rights systems and agricultural development in sub-Saharan Africa, Agriculture and Rural Development Department Report No. 64, Washington DC: World Bank.

Garrity, D., Dixon, J. & Boffa, J. M. (2012). Understanding African Farming Systems Science and Policy Implications: Bridging research and practices. In *Paper prepared for Food Security in Africa*. Sydney.

Gemechis, A. O., Struil, P.C. & Emana, B. (2012). Tomato production in Ethiopia: Constraints and Opportunities. Paper presented at the International Research on Food Security, Natural Resource Management and Rural Development Conference in Gottingen, Germany.

Gobena, G. K. (2012). Analysis of smallholder farmer's participation in production and marketing of export potential crops: The case of sesame in Diga district, East Wollega zone of Oromia regional state. Addis Ababa University, Ethiopia.

Google Maps (2015). *Map of Umzimkhulu and Ndwedwe local municipalities within KwaZulu-Natal province of South Africa*. [Online]. Retrieved from: https://www.googlemaps.co.za. Accessed on 15 July.

GRAIN. (2014). Hungry for land: Smallholder farmers feed the world with less than a quarter of farmland. Report, 12.

Greene, W. H. (1993). *Econometric Analysis*. Macmillan, London.

Haggblade, S., Hazell, P. B. R. and Brown, J. (1990). Farm-nonfarm linkages in rural Sub-Saharan Africa. *World Development Studies 17* (8), 1173- 1201.

Haitovsky, Y. (1969). Multicollinearity in Regression analysis. *Review of Economics and Statistics, 51* (1), 486- 489.

Hanmer, L. and Naschold, F. (2001). Attaining the international developments targets: Will growth be enough? Paper presented at the WIDER Development Conference on Growth and Poverty. Helsinki.

Hatcher, L. & Stepanski, E. (1994). A step-by-step approach to using the SAS system for univariate and multivariate statistics. Cary, NC: SAS Institute Inc.

Hazell, P., Poulton, C., Wiggins, S. and Dorward, A. (2007). The future of small farms for poverty reduction and growth. International Food Policy Research Institute (IFPRI). *Discussion Paper 42*. Washington, D.C.

Hedman, B., Perucci, F. & Sundstrom, P. (1996). Engendering Statistics: A tool for change. *Statistics Sweden*. Orebro.

Hill, M. A. (1983). Female labour force participation in developing and developed countries: Consideration of the informal sector. *Review of Economics and Statistics, 63* (3), 459-468.

HLPE (High Level Panel of Experts). (2013). *Investing in smallholder agriculture for food security. Food Security and Nutrition: Comparative study of constraints to smallholder agricultural investment*. [Online]. Retrieved from: www.fao.org. Accessed on 15 June.

Hogset, H. (2005). Social Networks and Technology Adoption. Paper prepared for presentation at the American Agricultural Economics Association Annual Meeting, Providence, Rhode Island.

IAC (2004). *African agricultural production systems and productivity in perspective*. [Online]. Retrieved from: https://www.interacademycouncil.net.html. Accessed on 14 September.

ILRI (International Livestock Research Institute). (1996). ILRI 1995: Building a Global Research Institute. ILRI, Nairobi, Kenya.

Iyai, D.A., Woran, D. and Sumpe, I. (2012). Clustering and Principal Component Analyses of Constraints in Smallholding Pig Keeping Systems in Manokwari, Indonesia. *Animal Production, 12* (3), 199- 206.

Jacobs, P. T. (2009). *Agricultural market reforms and the rural poor in South Africa*. [Online]. Retrieved from: https://www.plaas.org.za. Accessed on 15 October.

Jayne, T. S., Mather, D. & Mghenyi, E. (1999). Principal challenges confronting smallholder agriculture in Sub-Saharan Africa. *World Development, 38* (10), 1371.

Jayne, T.S. (2010). Do high food marketing costs constrain cash crop production in smallholder agriculture? Evidence from Zimbabwe. *Economic Development and Cultural Change, 42* (2), 337– 400.

Jordaan, H., Grove, B. & Backeberg, G. R. (2014). Conceptual framework for value-chain analysis for poverty alleviation among smallholder farmers. *Agrekon, 53* (1), 5- 28.

Jariko, G. A. (2011). Socioeconomic factors affecting adoption of sunflower varieties in Sindh. *Pakistan Journal of Commerce and Social Sciences, 5* (1), 192- 201.

Karugia, J., Wanjiku, J., Nzuma, J., Gbegbelegbe, S., Macharia, E., Massawe, S., Freeman, A., Waithaka, M. and Kaitibie, S. (2009). Responding to food price crisis in Eastern and Southern Africa: Policy options for national and regional Action, *Working Paper, No. 27*. IFPRI, Washington, DC.

Khapayi, M. and Celliers, O.R. (2016). Factors limiting and preventing emerging farmers to progress to commercial agricultural farming in King Williams Town area of the Eastern Cape Province, South Africa. *South African Journal of Agricultural Extension, 44* (1), 1-6.

Kim, J. O. & Mueller, C. W. (1978). Introduction to factor analysis: What it is and how to do it. Beverly Hills, CA: Sage.

Kimhi, A. (1994). Participation of farm owners in farm and off- farm work including the option of full-time off-farm work. *Journal of Agricultural Economics, 45* (2), 232-239.

Kirsten, J. & van Zyl, J. (1998). Defining small-scale farmers in the South African context. *Agrekon, 37* (4), 35- 52.

Koo, J. (2014). *Improving yields of smallholder farmers: IFPRI*. [Online]. Retrieved from: https://harvestchoice.org/topics/input-use. Accessed on 15 January.

Koutsoyiannis, A. (1987). Theory of econometrics: an introductory exposition of econometric methods. *2nd edition*. London.

Kremen, C., Iles, A. and Bacon, C. (2012). Diversified farming systems: An agro-ecological, systems-based alternative to modern industrial agriculture. *Ecology and Society, 17* (4): 44.

Lahiff, E. & Cousins, B. (2005). Smallholder agriculture and land reform in South Africa. *Institute of Development Studies, 36* (2), 125.

Limbu, F. (1999). Agricultural technology: Economic viability and poverty alleviation in Tanzania. Paper presented at the structural transformation policy workshop. Tegemeo Institute and Michigan State University. Nairobi.

Lyne, M. C. (1996). Transforming developing agriculture: Establishing a basis for growth. *Agrekon, 35* (4): 188- 192.

Mabuza, E. S. (2009). *The contribution of agriculture to the economic growth of South Africa* (masters thesis, University of Johannesburg).

Machethe, C. (2004, October). Agriculture and poverty in South Africa: Can agriculture reduce poverty? Paper presented at the Overcoming Underdevelopment Conference. Department of Agricultural Economic, Extension and Rural Development. Pretoria, South Africa.

Machingura, C. (2007). *An analysis of factors that can be used to identify successful smallholder farmers: A case study of Mbhashe and Ngqushwa* (masters thesis, University of Fort Hare).

Maddala, G. S. (1983). Limited dependent and qualitative variables in econometrics. Econometric Society Monographs. *Cambridge University Press*, Cambridge.

Maddala, G. S. (1990). Limited Dependent and Qualitative Variables in Econometrics. *Cambridge University Press*, Cambridge.

Mahabile, M., Lyne, M. C. and Panin, A. (2002). Factors affecting the productivity of communal and private livestock farmers in Southern Botswana: A descriptive analysis of sample survey results. *Agrekon, 41* (4), 326- 338.

Makhura, T. M. (2001). *Overcoming transaction costs barriers to market participation of smallholder farmers in the Northern Province of South Africa* (doctoral thesis, University of Pretoria).

Maliwichi, L.L., Pfumayaramba, T.K. & Katlego, T. (2014). An analysis of constraints that affect smallholder farmers in the production of tomatoes in Ga-Mphahlele, Lepelle Nkumbi Municipality, Limpopo province of South Africa. *Journal of Human Ecology, 47* (3), 251- 225.

Manly, B. F. J. (2005). Multivariate Statistical Methods: A Primer, Chapman and Hall, London.

Manona, S. S. (2005). *Smallholder subsistence agriculture as local economic development strategy in rural South Africa: Exploring prospects in Pondoland, Eastern Cape* (masters thesis, Faculty of Economic and Management Sciences, University of Western Cape).

Mashingaidze, I. (2012). Re-tooling of African smallholder farmers for modernised agriculture. The Food, Agriculture and Natural Resources Policy Analysis Network (FANRPAN). South Africa Trust & IDASA, Pretoria, South Africa.

Matungul, P. M, Ortmann, G. F. & Lyne, M. C. (2012). Marketing methods and income generation among small-scale farmers in two communal areas of KwaZulu-Natal of South Africa: *Research Article*. School of Agricultural Sciences and Agribusiness. University of KwaZulu-Natal, Pietermaritzburg, South Africa.

Marenya, P. P. & Barrett, C. B. (2011). Household-level determinants of adoption of improved natural resources management practices among smallholder farmers in

western Kenya. Department of Natural Resources Cornell University, Warren Hall, Ithaca.

Matsane, S. H. & Oyekale, A. S. (2014). Factors affecting marketing of vegetables among small-scale farmers in Mahikeng Local Municipality, North West Province, South Africa. *Journal of Social Sciences, 5* (20), 385- 391.

MCC (Millennium Challenge Corporation). (2013). Guidelines for conducting a constraint analysis. [Online]. Retrieved from: www.mcc.gov. Accessed on 16 December.

Minot, N. & Ngigi, M. (2003). Are horticultural experts a replicable success story? Success in African agriculture: Building for the future. International Food Policy Research Institute, Washington DC.

Mhlaba, S. & Brey, Z. (2014). *Smallholder agriculture: job creator or livelihood provider?* [Online]. Retrieved from: http://www.dnaeconomics.com.html. Accessed on 15 September.

Mlengana, M. (2012). *Minister's speech on the occasion of the first African Farmers Association of South Africa (AFASA) annual general meeting: International and Local Agricultural Unions*. [Online]. Retrieved from: www.afasa.org.za. Accessed on 15 June.

Monde, N. (2007). Obstacle to Agricultural Development in the communal smallholder sector and the role of extension services. University of Fort Hare, Alice.

Muchara, B. (2011). *Analysis of food value chains in smallholder crop and livestock enterprises in Eastern Cape Province of South Africa* (masters thesis, University of Fort Hare).

Mudhara, M. (2010). Agrarian transformation in smallholder agriculture in South Africa: A diagnosis of bottlenecks and public policy options. Paper presented at the 'Overcoming inequality and structural poverty in South Africa: Towards inclusive growth and development' conference held in Johannesburg. University of KwaZulu-Natal, South Africa.

Mudombi-Rusinamhodzi, G. Sizuba, S. and Kongo, V. (2012). Factors affecting smallholder farmers' responsiveness to climate variability induced hazards in Zimbabwe. *African Crop Science Journal, 20*, pp. 297- 301.

Mutabazi, K., Wiggins, S. & Mdoe, N. (2013). *Commercialisation of African Smallholder Farming. The case of smallholder farmers in Tanzania.* [Online]. Retrieved from: https://www.future-agricultures.org.html. Accessed on 15 October.

Musemwa, L., Mushun, A., Chimonyo, M., Fraser, G., Mapiye, C. and Muchenje, V. (2008). Review: Nguni cattle marketing constraints and opportunities in communal areas of South Africa. *African Journal of Agricultural Research 14*, pp. 239- 245.

Mussa, E. C., Obare, G. A., Bogale, A. and Simtowe, F. P. (2012). Analysis of resource use efficiency in smallholder mixed crop-livestock agricultural systems: Empirical evidence from the central highlands of Ethiopia. *Developing Country Studies, 2* (9), 30-36.

Nagayets, O. (2005). Small farms: Current status and key trends. Prepared for the future of small farms. Research workshop. Wye College.

National Survey (2011). *Municipal Fact Sheet: Municipalities of KwaZulu-Natal. Statistics South Africa*. [Online]. Retrieved from: http://en.wikipedia.org. Accessed on 15 November.

Narayanan, S. and Gulati, A. (2002). Globalization and the smallholders: A review of issues, approaches and implications: Markets and Structural Studies Division IFPRI. *Discussion Paper nr. 50*. Washington, DC.

Ngcobo, H. & Dladla, B. (2002). Provincial report on education and training for agriculture and rural development in KwaZulu-Natal. KZN Department of Agriculture.

Ngemntu, S. T. (2010). *An investigation of the production and marketing challenges faced by smallholder farmers in Amahlathi Municipality: A case study of Zanyokwe irrigation scheme and Silwindlala woman's project* (masters thesis, University of Fort Hare, Alice).

Ngqangweni, S. (1999). Exploring growth linkages in a South African smallholder farming area. Agrekon, *38* (4), 192.

Nompozolo, S. (2000). *An analysis of the characteristics and constraints of smallholder commercial farmers in the Transkei Region* (masters thesis, University of Fort Hare, Alice).

Nothard, B.W., Ortmann, G. F. and Meyer, E. (2005). Institutional and resource constraints that inhibit contractor performance in the small-scale sugarcane industry in KwaZulu-Natal. *South African Journal of Agricultural Extension, 34* (1), 53- 82.

Norton, G. W., Alwang, J. & Masters, W. A. (2010). Economics of Agricultural Development: World food systems and resource use. *2nd Ed*. Routledge, Abingdon, Oxon.

Njuki, J., Kruger, E. & Starr, L. (2013). Increasing the productivity and empowerment of women smallholder farmers. *Baseline Assessment*. Africa and Asia.

Nkamleu, G. B., Gokowski, J. and Kazianga, H. (2003, August). Explaining the failure of agricultural production in sub-Saharan Africa. Proceedings of the 25th International Conference of Agricultural Economists, Durban, South Africa.

Odhiambo, J. J. O. and Magandini, V. N. (2008). An assessment of the use of mineral and organic fertilizers by smallholder farmers in Vhembe district, Limpopo province, South Africa. *African Journal of Agricultural Research, 3* (5), 357- 362.

Oettle, N., Fakir, S., Wentzel, W., Giddings, S. & Whiteside, M. (1998). Agricultural services in southern Africa: Encouraging sustainable smallholder agriculture in South Africa. Glos: Environment and Development Consultancy, Ltd.

Ojo, M. A., Nmadu, J. N., Tanko L. and Olaleye. R. S. (2013). Multinomial logit analysis of factors affecting the choice of enterprise among small-holder Yam and Cassava farmers in Niger State, Nigeria. *Journal of Agricultural Sciences 4* (1), 7- 12.

Omamo, S. W. (2005). The future of smallholder farming in eastern Africa: The roles of states, markets, and civil society. Proceedings of conference of the IFPRI eastern Africa food policy network. Imperial Resort Beach Hotel, Entebbe, Uganda.

Ortmann, G. F. & King, R. P. (2006). Small-scale farmers in South Africa: Can agriculture cooperatives facilitate access to input and product markets? (*Staff Paper Series*). University of Minnesota, Minnesota, USA.

Ovuka, M. & Ekbom, A. (1999). Farmers' Resource Levels, Soil Properties and Productivity in Kenya's Central Highlands. (Paper presented at the 10th International Soil Conservation Organization Meeting held at Purdue University and the USDA-ARS National Soil Erosion Research Laboratory). University of Purdue, Indiana.

Pannella, D. J., Llewellynb, R.S., & Corbeelsca, M. (2014). The farm-level economics of conservation agriculture for resource-poor farmers. School of Agricultural and Resource Economics, University of Western Australia.

Pauw, K. W. (2007). Agriculture and poverty: Farming for food or farming for money? *Agrekon, 46* (2), 196- 209.

Peacock, C., Jowsett, A., Dorward, A., Poulton, C. and Urey, I. (2004). *Reaching the Poor, A Call to Action: Investment in Smallholder Agriculture in sub-Saharan Africa*. FARM-Africa, Harvest Help and Imperial College, London.

Peden, R. (2012). *Farm fencing- Reasons for fencing on farms*. [Online]. Retrieved from: http://www.TeAra.govt.nz/en/farm-fencing/page-1. Accessed on 16 June.

Perdeson, G. (2003). Rural finance institutions, markets and policies in Africa. Paper presented at a Pre-IAAE Conference on African Agricultural Economics, Bloemfontein, South Africa.

Perret, S. & Kirsten, J. F. (2000). Rural development: focussing on small-scale agriculture in southern Africa (Published paper). Department of Agricultural Economics, Extension and Rural Development. Pretoria, South Africa.

Pienaar, P. L. (2003). *Typology of Smallholder Farming in South Africa's Former Homelands: Towards an Appropriate Classification System* (masters thesis, Agricultural Economics, Faculty of Agricultural Sciences, University of Stellenbosch, South Africa).

Pote, P. P. T. (2008). *Technical constraints to smallholder agriculture: case study of Nkonkobe municipality, Eastern Cape, South Africa* (masters thesis, University of Fort Hare).

Punt, C., Pauw, K., van Schoop, M., Nyhodo, B., McDonald, S., Chant, L. and Valente, C. (2005). A profile of KwaZulu-Natal: Demographics, poverty, inequality and unemployment. *Background Paper, 1* (5), Elsenburg, South Africa.

Rahji, M. A. Y. and Fakayode, S. B. (2009). A multinomial logit analysis of agricultural credit rationing by Commercial Banks in Nigeria. *International Journal of Finance and Economics, 34* (5), 86- 93.

Reardon, T. and Barrett, C. B. (2000). Agro-industrialization, globalization and international development: An overview of issues, patterns and developments. *Agricultural Economics, 23*, pp. 195- 202.

Rosenthal, C. and Marshall, V. (1987). The head of the family: Social meaning and structural variability. *The Canadian Journal of Sociology, 11* (2), 183-198.

Rosset, P. M. (1999). The multiple functions and benefits of small farm agriculture: In the context of global trade negotiations. The Institute for Food and Development Policy, Oakland, CA, USA.

Rota, A. (2010). Integrated crop-livestock farming systems: Tools for project design. *Livestock thematic papers*. IFAD, Rome, Italy.

Ruttan, V. W. (2002). Productivity growth in world agriculture: Sources and constraints. *Journal of Economic Perspectives, 16* (4), 152- 172.

Salami, A., Kamara, A. B. & Brixiova, Z. (2010). *Smallholder agriculture in East Africa: Trends, production constraints and opportunities.* [Online]. Retrieved from: https://www.afdb.org.html. Accessed on 15 September.

Samarth (2016). *Crop protection inputs: Nepal Market Development Programme (NMDP)*. [Online]. Retrieved from: www.samarth-nepal.com. Accessed on 16 December.

Schnedler, W. (2005). Likelihood estimation for censored random vectors. *Discussion Paper Series No. 417*. Department of Economics, Heidelberg University.

Schnitzer, P., Tinonin, C. and Azzarri, C. (2014). Ghana Agricultural Snapshot 2005/6. *Working Paper*. HarvestChoice - International Food Policy Research Institute (IFPRI).

Senyolo G.M, Chaminuka P, Makhura M.N and Belete A, (2009). Patterns of access and utilization of output markets by emerging farmers in South Africa: Factor analysis approach. *African Journal of Agricultural Research, 4* (3): 211- 114.

Sibanda, L. M. (2012). *Strengthening the capacity of women farmers to influence agricultural policy development in Africa: Women accessing realigned market projects.* [Online]. Retrieved from: http://www.fanrpan.org. Accessed on 15 April.

Sindi, J. K. (2008). *Kenya's domestic horticulture subsector: What drives commercialization decisions for rural households?* (masters thesis, Michigan State University, United States).

Shange, N. (2014). *Analysis of challenges and opportunities for smallholder farmer value chain integration in the Western Cape: A public and private sector organisation perspective* (masters thesis, University of Stellenbosch).

Shields, M. L., Rauniyar, G. P. and Good, F. M. (1993). A longitudinal analysis of factors influencing increased technology adoption in Swaziland. *Journal of Developing Areas, 27* (4), 469– 484.

Sihlobo, W. (2015). *The youth are agriculture's future. Mail & Guardian.* [Online]. Retrieved from: http://mg.co.za/article/2015-06-18-the-youth-are-agricultures-future. Accessed on 15 March.

Sikwela, M. M. (2013). *The impact of farmer support programmes on market access of smallholder farmers in the Eastern Cape and KwaZulu-Natal provinces, South Africa* (doctoral thesis, University of Fort Hare, Alice).

Sims, H. (1993). Economic imperatives, political risks, and modes of action: Agricultural policy implementation in India and Pakistan. *J. Dev. Areas, 27*, pp. 147- 156.

Somda, J., Kamuanga, M & Tollens, E. (2005). Resources endowment, income distribution and needs for technologies among peri-urban smallholders in The Gambia. Institute of Environment and Agricultural Research. University of Leuven, Belgium.

Sotshongaye, A. and Moller, V. (2000). 'We want to live a better life like other people': Self-assessed development needs of rural women in Ndwedwe, KwaZulu-Natal. *Development Southern Africa, 17* (1), 117- 134.

Stats SA. (2011). General household survey: Revised version: Pretoria, South Africa.

Stats SA. (2012). General Household Survey. Food Security and Agriculture (2002- 2011): In-depth analysis of General Household Survey, *Vol. 5*. Statistics South Africa, Pretoria, South Africa.

Starkweather, J. and Moske, A. K. (2011). *Multinomial logistic regression*. [Online]. Retrieved from: http://www.readbag.com. Accessed on 16 August.

Stevens, J. (1986). Applied multivariate statistics for the social sciences. Hillsdale, NJ: Lawrence Erlbaum Associates.

Swagata, P. (2016). *Mixed fertilizers: Types, granulation and advantages.* [Online]. Retrieved from: www.soilmanagementindia.com. Accessed on 16 November.

Tamirat, M. (2013). Financial constraints and entrepreneurial activity choice among clients of micro finance institutions in Jimma area. *Journal of Development and Agricultural Economics, 5* (12), 510- 518.

Tesfay, Y. Y. (2014). A new econometric model to analyse variations and structural changes in international trade. *International Journal of Trade and Global Markets, 8* (4), 343- 370.

Thamaga-Chitja, J. M. and Morojele, P. (2014). The Context of Smallholder Farming in South Africa: Towards a Livelihood Asset Building Framework. *Journal of Hum. Ecol., 45* (2), 147- 155.

Thapa, G. (2009, May). Smallholder Faming in Transforming Economies of Asia and the Pacific: Challenges and Opportunities. (Discussion paper): Prepared for the side event organised during the Thirty-third Session of the International Fund for Agricultural Development (IFAD)'s governing Council.

Timmer, C. P. (1997). Farmers and markets: The political economy of new paradigms. *American Journal 79*, pp. 621- 627.

Tittonell, P., Muriuki, A., Shepherd, K., Mugendi, D., Kaizzi, K., Okeyo, J., Verchot, L., Coe, R. & Vanlauwe, B. (2010). The diversity of rural livelihoods and their influence on soil fertility in agricultural systems of East Africa: A typology of smallholder farms. *Agricultural systems*, 103, pp. 78- 92.

Todaro, M. P. (1989). Economic Development in the Third World Countries (*4th Edition*). Longman, London.

Todaro, M. P. and Smith S. C. (2006). Economic Development: Diverse structures and common characteristics of developing nations, *9th edition*. Addison Wesley, London.

Uchezuba, I. D., Moshabele, E. & Digopo, D. (2009). Logistical estimation of the probability of mainstream market participation among small-scale livestock farmers: a case study of the Northern Cape Province. *Agrekon, 48* (2), 161- 172.

USAID. (2008). Moving from subsistence to commercial farming in Uganda. *Agricultural Productivity Enhancement Program Final Report*. Chemonics International Inc.

Van Averbeke, W. and Mohamed, S. S. (2006). Smallholder farming styles and development policy in South Africa: The case of Dzindi irrigation scheme. *Agrekon 45* (2), 136-157.

Van Rooyen, C. J., Vink, N. & Christodoulou, N. T. (1995). Access to the agricultural market for small farmers in Southern Africa: The farmer support program. DBSA.

Vink, N. & Van Rooyen, J. (2009). The economic performance of agriculture in South Africa since 1994: Implications for food security. DBSA.

Wiggins, S., Kirsten, J. and Llmbi, L. (2010). The Future of Small Farms. *World Development, 38* (10), pp. 1334.

Woodridge, J. M. (2001). *Multiplicative Panel Data Models without the Strict Exogeneity Assumption*. [Online]. Retrieved from: https://doi.org. Accessed on 16 September.

World Bank. (2003). Reaching the rural poor: A renewed strategy for rural development. Washington, DC.

World Bank (2016). *Agriculture overview: Working for a world free of poverty*. [Online]. Retrieved from: www.worldbank.org. Accessed on 16 June.

Xaba, B. G. & Masuku, M. B. (2012). *Factors affecting the choice of marketing channel by vegetable farmers in Swaziland*. [Online]. Retrieved from: https://dx.doi.org. Accessed on 15 October.

Zarenda, H. (2013). South Africa's National Development Plan and its implications for regional development. Stellenbosch: tralac.

APPENDIX

APPENDIX A: Research questionnaire

Production constraints across selected smallholder farming systems in KwaZulu-Natal province

INTRODUCTION

My name is _____ from the University of KwaZulu-Natal. The University is conducting a research that is looking at **production constraints facing smallholder farmers in KwaZulu-Natal.** There are no right and wrong answers to the questions. The information will be treated as **CONFIDENTIAL** and is solely for academic purposes. Your partaking in this research study is completely voluntary. The interview will take about 45 minutes.

IDENTIFICATION

Interviewer name		**Date of interview**	
Key respondent's name			
Local municipality		**Ward**	

SECTION A: HOUSEHOLD DEMOGRAPHICS

A1. Please answer the following with respect to the household head*.

A1.1 What is the household name? …….

A1.2 What is the gender of the household head? (*Please tick the appropriate response.)*	*1=Male*	
	0=Female	
A1.3 What is the age of the household head? (*in years*)		
A1.4 What is the marital status of the household head? (*Please tick the appropriate response.)*	*1=Single*	
	2=Married	
A1.5 Education level of the household head *(specify e.g. Grade 5)*		
A1.6 Number of active household members, over the age of 12 years *(please specify)*		

A1.7 What is the occupation of the household head? *(Please tick the appropriate response)*	*1=Fulltime farmer*	
	2=Part-time farmer	
	3=Other (specify) ……	

**Household head refers to the de facto household head that stays in the household for 4 days or more per week*

SECTION B: HOUSEHOLD LIVELIHOOD STRATEGIES

B1 Farming activities

B1.1 Livestock activities

B1.2 Is your household involved in **livestock activities**? *(Please tick the appropriate response)*	*1=Yes*	
	0=No	

B1.2.1 If your household is involved in **livestock activities**, please complete the **livestock income** table below

Type of livestock	**Current herd size**	**Number <u>bought</u> in the last 3 years**	**Number <u>sold</u> in the last 3 years**	**Sales (R)**
1=Cattle				R
2=Goats				R
3=Sheep				R
4=Horses				R
5=Pigs				R
6=Domestic chickens				R
7=Other (specify)				R

B1.2.2 If you have sold your livestock, who are the major buyers?	**Type of livestock**	**Major buyers for livestock** *1=Private sales* *2=Auctions* *3=Neighbours* *4=Speculators* *5=Slaughterhouses* *6=Other (specify): ……*
	1=Cattle	
	2=Goats	
	3=Sheep	
	4=Horses	
	5=Pigs	
	6=Domestic chickens	
	7=Other (specify)	

B1.2.3 What is the main purpose for engaging in **livestock activities**? *(Tick the appropriate response(s)*	*1=Household consumption*	
	2=Marketing	
	3=Leisure pursuit	
	4=Cultural purposes	
	5=Home consumption and marketing	
	7=Other (specify)……	

B2.1 Crop activities

B2.2 Is your household involved in **crop activities**? *(Please tick the appropriate response)*	*1=Yes*	
	0=No	

B2.2.1 If your household is involved in **crop activities**, please complete the **crop income** table below

Vegetable/ Field crops	Hectares (ha) Allocated season (2014-15)	Output (bags or kgs or, bundles etc.)	Quantity consumed (bags or kgs or, bundles etc.)	Quantity sold (Bags or kgs or, bundles etc.)	Selling price (R) per (bags or kgs or, bundles etc.)
1=Vegetables					R
2=Field crops					R
B2.2.2 Do you produce fresh produce for the market? *(please tick the appropriate)*				*1=Yes*	
				0=No	
B2.2.3 Do you have access to market information regarding produce prices, potential markets, etc.? *(please tick the appropriate)*				*1=Yes*	
				0=No	

B2.2.4 If you sold your crops, who are the major buyers?	**Field Crop/Vegetable crops**	**Major buyers for field/ vegetable crops** *1=Neighbouring communities* *2=Hawkers* *3=Agro-processors* *4=Local shops* *5=Fresh produce market* *6=Other (specify): ……*
	1=Field Crops	
	2=Vegetable crops	

B2.3 What is the main purpose for this engaging in **cropping activities**? *(Tick the appropriate response(s)*	1=Household consumption	
	2=Marketing	
	3=Leisure pursuit	
	4=Cultural purposes	
	5=Home consumption and marketing	
	7=Other (specify)……	

B2.4 Please indicate the source(s) of labour for each farming activity performed within the household.	Source(s) of labour *1=Family labour* *2=Hired labour* *3=Labour exchange*	Which family member(s) is/are responsible for the **farming activities**? *(specify number e.g. 3 males)* *1=Male 2=Female* *3=Both 4=None*
1=Livestock		
2=Cropping		
5=Other *(specify):* …….		
…….		

SECTION C: PRODUCTION INPUTS

C1.1 Did you use inorganic fertilizers for the current production season 2014/15? *(Tick the appropriate response)*	*1=Yes*	
	0=No	

C1.2 If, yes, please complete the table below.

Field /Vegetable crops	Quantity of inorganic fertilizer Purchased *(in kg)*	Quantity of inorganic fertilizer applied *(in kg)*
1= Field Crops		
2=Vegetable Crops		

C1.3 Did you mix inorganic fertilizer with organic sources of fertility (e.g. animal manure, compost, etc.*)?(Tick the appropriate response)*	1=Yes	
	0=No	
C1.4 Do you use improved seeds in crop production? *(Tick the appropriate response)*	1=Yes	
	0=No	

C1.5 If yes to **C1.3** and **C1.4**, complete the table below

Production inputs	Please indicate the sources of improved seed and inorganic fertilizer *1=government 2=commodity organisations* *3=private companies 4=cooperatives* *5=fellow farmers 6=non-governmental organisations* *7=other (please specify)……*
1= Inorganic fertilizer	
2= Improved seeds	

SECTION D: PHYSICAL CAPITAL

C1.1 Please complete the table below regarding farm assets?

Farm assets	Assets used *1= Yes* *0=No*	Means of accessing assets (*Please Tick)*			Nr. of assets	Value (R)	Do you consider the assets to be adequate for farming activities *1=Yes* *0=No*
		1=Owned	*2=Hired*	*3=Borrowed*			
1=Hand Hoes						R	
2=Tractors						R	
3=Cultivators						R	
4=Shovels						R	
5=Fork spade						R	
6=Planter						R	

7=Vehicle						R	
8=Watering cans						R	
9=Other (specify)						R	

SECTION E: FARMING PRACTICES

E1.1 Please select **only** one choice of adopted farming practice.	Farming practices	*(Please tick the most appropriate response)*
	1=Subsistence crop farming	
	2=Improved crop farming	
	3=Mixed crop-livestock farming	
	4=Commercial farming	
	5=Other (please specify) ……..	

SECTION F: CONSTRAINTS

F1.1 What are the main constraints that affect your agricultural production?	(*Please indicate by ticking the most appropriate response.*) *1=Yes* *0=No*
1=Limited access to agricultural land	
2=Poor physical farm infrastructure	
3=Limited access to formal markets	
4=Limited access to farm credit	
5=Lack of improved farm inputs	
6=Limited access to market information	
7=Lack of proper storage facilities	
8=High transaction costs	
9=Lack of bargaining power	
10=Lack of hired human capital	
11=Technological barriers	
12=Lack of extension and farmer support	
13=Other *(specify)*: ……..	

SECTION G: NATURAL CAPITAL

G1.1 Please indicate the type of land tenure system, total land size, area under farm production and the condition of the field.	Type of land tenure: *1=Bought (Title deed)* *2=Lease state land* *3=Inherited* *4=Freehold* *5=Renting* *6=Share cropping* *7=Other (specify)*	Total land size (ha)	Area utilised under each plot in the last 12 months (ha)	Field condition *1= Fenced* *2=Partly fenced* *3=Not fenced*
1=Homestead garden				
2=Dry-land				

3=Irrigated land				
4=Other (specify)				

G1.2 How do you feel about your land size? *(Please tick the most appropriate response)*	*1=Too small*	
	2=Just right	
	3=Too large	

SECTION H: SOCIAL CAPITAL

H1.1. In what way do you practise agriculture? *(Tick the appropriate(s))*	*1=As an individual or a household*	
	2=As a member of an informal group	
	3=As a member of a cooperative	
	4=Other (specify)……	

SECTION I: HOUSEHOLD INCOME

I1.1 Off-farm income

I1.2 Do you earn **off-farm income**? (*Please indicate by ticking against the appropriate response.*)	*1=Yes*	
	0=No.	

I1.3 If yes to **I1.2,** complete **I1.4**

I1.4 Please indicate the type of off-farm activities in which off-farm income is derived, frequency of earning and wage rate. *1=handicrafts,2=lumbering,3=formal employment, 4=unskilled wage labour, 5=beer brewing, 6=shoe repairing, 7=barbering, 8= butchery, 9=Other(specify)*	Frequency of earning off-farm income *1=daily 2=weekly 3=monthly 4=other (please specify) ……*	Wage rate Rand per (specify)
		R
		R
		R
		R
		R

I2.1 Remittance income

I2.2 Do you receive **Remittance Income**? (*Please indicate by ticking against the appropriate response.*)	*1=Yes*	
	0=No.	

I2.3 If yes to **I2.2**, complete the table below.

Remittance income received from friends and relatives **not** presently living at the household.

Remitter *1=Relative* *2=Friend* *3=Other (specify)*	**Gender** *1=Male* *2=Female*	**Frequency** *1=Monthly* *2=every two months* *3=every three months* *4=Other (please specify)*	**Amount received (R)**
			R
			R
			R
			R

I3.1 Government grant

I3.2 Are there any household members that receive a government grant? *(Tick the appropriate)*	*1=Yes*	
	0=No	
I3.3 If yes, please indicate how many members receive:	*Old age grant*	
	Child grant	
	Disability grant	
	Foster child grant	
	Care dependency grant	

SECTION J: FINANCIAL CAPITAL

J1.1 Have you ever taken loan from an **informal place**?		*1=Yes*	
		0=No	
J1.2 If yes to **J1.1** above, what was the amount for the loan received? (*Please indicate below*)	**Purpose**		**R**
	1=Personal borrowing for household consumption		
	2=Farming/ agricultural		
	3=Other livelihood activity (specify)		
J1.3 If no to **J1.2** above, what was the reason? (*Tick the appropriate*)	*1=The interest rate was too high*		
	2=I could not secure the required collateral		
	3=I have my own funds		
	4=It isn't accessible		
	5=Other (specify) ……		

J2.1 Agricultural credit

J2.2 Have you received financial support in the form of grants from agricultural organizations? (*Tick the appropriate*)	*1=Yes*	
	0=No	

J2.3 If yes, please indicate in the table below the Farm support programme(s) in which credit was obtained (Please *tick the appropriate(s)*)		Value of grant received from each source (R) in the last 12 months
1=Ilima-Letsema		**R**
2=MAFISA		**R**
3=CASP		**R**
4=Techno Serve		**R**
5=Other (specify): ……		**R**

J2.4 If you accessed agricultural loans in the last 12 months please complete the table	Source of financial support (loan)	Value of the loan received from each source (R)	In which enterprise was the loan used for? *1=Cropping 2=Livestock 3=Both*	Did you miss any repayment for this loan? *1=Yes 0=No*	If you missed repayment, please indicate the reason *1=Agricultural loss 2=Abuse of funds 3=Other (specify)*
	1=Commercial bank				
	2=Land Bank				
	3=Family and Friends				
	4=Other (specify): ……				
J2.5 Have you ever applied for a loan before but did not get it?				*1=Yes*	
				0=No	
J2.6 If yes, what were the reasons for not getting the loan?	*1=Bad credit rating*				
	2=Unviable project proposal				
	3=Other (Specify)……				

SECTION K: HUMAN CAPITAL ENDOWMENT

K**1.1** Has any household member(s) received any kind of training/education in the last 12 months?		*1=Yes*	
		0=No	
K1.2 If **yes,** which form of training? *(Please list)*	Skills obtained	Who offered the training?	
	1.		
	2.		
	3.		

SECTION L: OTHER COMMENTS

……

……

……

……

……

……

Thank you for your time